VOL. 6 NO. 10
May 31, 1981

Energy Research Abstracts

ABSTRACTS 13283-15179

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications which are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the energy data base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $3.00, foreign $3.75 per copy; annual cumulative index, domestic $4.00, foreign $5.00 per copy. The annual subscription price is $38.00 for domestic subscribers and $47.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. Indexes are cumulated semiannually and annually. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues including a semiannual index and an annual index is $184.00 for domestic subscribers and $230.00 for foreign subscribers. The semiannual and annual indexes will also be available separately to subscribers. The cost for the semiannual index is $18.00 (domestic) or $22.50 (foreign); the annual index is $33.00 (domestic) or $41.25 (foreign). A single issue costs $5.55 (domestic) or $6.95 (foreign).

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A monthly publication providing abstracting and indexing coverage of the international patent literature, including patent applications, that concerns any aspect of energy production, conservation, and utilization. Available as PB81-902800.

Energy Conservation Update (ECU)

A monthly abstract journal devoted to current information on energy conservation in buildings, transportation and propulsion, and industry; waste processing plants and equipment; energy storage; energy conversion; advanced automotive systems; combustion systems; power cycles; synthetic fuels; and power transmission. Available as PB81-914800.

Energy and the Environment (EAE)

A monthly abstract journal devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment. Available as PB81-914900.

Fossil Energy Update (FEU)

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB81-914600.

Fusion Energy Update (CFU)

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB81-915300.

Geothermal Energy Update (GEU)

A monthly abstract journal devoted to information on the exploration and development of geothermal resources. Available as PB81-914700.

Solar Energy Update (SEU)

A monthly abstract journal devoted to information on the utilization of solar, tidal, and wind energy. Available as PB81-914500.

Synthetic Fuels Update (SFU)

A monthly abstract journal devoted to information on coal gasification; coal liquefaction; other coal processing; biomass conversion to fuel; shale oil and tar sand bitumen production; hydrogen fuels; other hydrocarbon fuels; alcohol fuels; and inorganic hydrogen compound fuels. Available as PB81-902700.

INTERNATIONAL ENERGY PUBLICATIONS

Atomindex (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, P.O. Box 433, Murray Hill Station, New York, NY 10016. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $150.

Coal Abstracts (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides all non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the DOE/RECON Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

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The Technical Information Center, as the national information center for the Department of Energy, manages, publishes, and disseminates scientific, technical, and practical energy information acquired from worldwide sources. It builds and maintains energy information data bases used to prepare abstracting journals, bibliographies, and literature searches. The data bases are also searchable via the Department's on-line retrieval system, DOE/RECON. This information is provided to DOE program offices and contractors; scientists; engineers; educational, commercial, and industrial communities; and the general public. The Technical Information Center conducts an active announcement and marketing program. It establishes policy and administers control of an inventory and registry for DOE publications. The Center also develops and evaluates new and effective information systems and services as required by scientific and technical management within the Department of Energy.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, conservation, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Federal, state, and municipal agencies concerned with energy development, conservation, and usage may obtain *ERA* free of charge. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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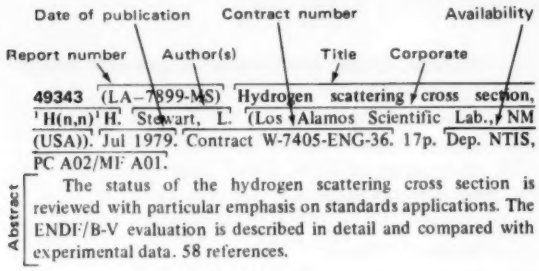
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Date of publication
Contract number
Availability
Report number
Author(s)
Title
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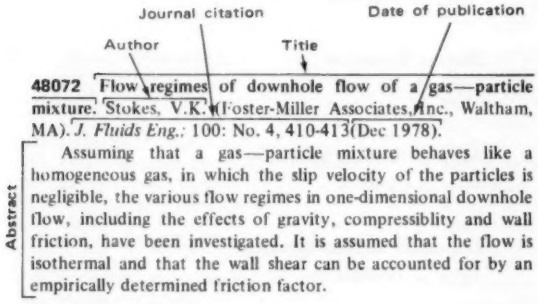
49343 (LA–7899-MS) Hydrogen scattering cross section, ¹H(n,n)¹H. Stewart, L. (Los Alamos Scientific Lab., NM (USA)). Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.
Abstract
The status of the hydrogen scattering cross section is reviewed with particular emphasis on standards applications. The ENDF/B-V evaluation is described in detail and compared with experimental data. 58 references.


Journal citation
Date of publication
Author
Title
48072 Flow regimes of downhole flow of a gas—particle mixture. Stokes, V.K. (Foster-Miller Associates, Inc., Waltham, MA). J. Fluids Eng.: 100: No. 4, 410-413 (Dec 1978).
Abstract
Assuming that a gas—particle mixture behaves like a homogeneous gas, in which the slip velocity of the particles is negligible, the various flow regimes in one-dimensional downhole flow, including the effects of gravity, compressiblity and wall friction, have been investigated. It is assumed that the flow is isothermal and that the wall shear can be accounted for by an empirically determined friction factor.

•INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. These indexes are cumulated semiannually and annually. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

•Corporate Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

49343 (LA–7899-MS) Hydrogen scattering cross section, ¹H(n,n)¹H. Stewart, L. **(Los Alamos Scientific Lab., NM (USA))**. Jul 1979. Contract W-7405-ENG-36. 17p. Dep. NTIS, PC A02/MF A01.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Advanced laser fusion target fabrication research and development proposal, 4:48249 (LA–7619-P)
Hydrogen scattering cross section, ¹H(n,n)¹H, 4:49343 (LA–7899-MS)

•Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Stewart, L., Hydrogen scattering cross section, ¹H(n,n)¹H, 4:49343 (LA–7899-MS)
Stewart, M.D., *See* McInroy, J.F., 4:49280
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Stimson, J., Reproduction, growth, and survival of Enewetak corals, 4:49200 (NVO–0703-1, pp 56-59)

•Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles and informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

HYDROGEN I TARGET
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Inventory of advanced energy technologies and energy conservation research and development: 1976-1978. Volume II. Prepared for the Committee on Science and Technology, U.S. House of Representatives, 96*th* Congress, 4:48749.

•Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos Scientific Lab., NM (USA)**	
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W-7405-ENG-48	**California Univ., Livermore (USA). Lawrence Livermore Lab.**	
	3:49386	UCRL–52456
	3:49431	UCRL–52405

•Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience.

LA-7899-MS	4:49343	Dep. NTIS, PC A02/MF A01
LA-tr-78-69	4:48158	Dep. NTIS, PC A03/MF A01

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts.* The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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13283 (DOE/ET/00234—31) Study of the treatability of wastewater from a coal-gasification plant. Final report, July 15, 1978-July 14, 1980. Iglar, A.F. (East Tennessee State Univ., Johnson City (USA). Dept. of Environmental Health). 1980. Contract AS22-78ET00234. 184p. NTIS, PC A09/MF A01.

This study focused on the coal gasification facility serving the Holston Army Ammunition Plant in Kingsport, Tennessee. Objectives were to characterize the wastewater produced by the gasification facility, and to evaluate technology for treating the waste in preparation for dischage to the environment. Most wastewater was recycled for scrubbing and cooling the product gas, with the excess requiring disposal found to be an average of only 1170 gallons per day (53 gallons per ton of coal, as received, and 366 gallons per million cubic feet of product gas). Analysis indicated that the waste was warm, high in alkaline material, especially ammonia, high in organic material, especially phenols, and also contaminated with other substances. Sulfides and thiocyanates were especially high in concentration. It was found that pretreatment could be accomplished by stripping (air injection) at high pH, removal of grease and oil (by pH suppression and light aeration) and neutralizatin. Equations were developed to describe the first two steps. Biological treatment through activated sludge was found to be successful, but effected only a moderate degree of treatment, and was troubled with frequent process upset. Attempts to improve treatment efficiency and stability are described. The data indicated the need to study aerated waste stabilization ponds as an alternative to activated sludge. Biological reaction kinetics were studied for activated sludge. Evaluation of the application of granular activated carbon suggested that this could be an effective practical tertiary treatment.

13284 (DOE/ET/10149—T5) Cold flow model for the H-Coal reactor. Part II. Data correlations. Vasalos, I.A.; Rundell, D.N.; Bild, E.M.; Tatterson, D.F. (Amoco Research Center, Naperville, IL (USA)). 1980. Contract AC05-77ET10149. 33p. NTIS, PC A03/MF A01.

Experiments at ambient temperatures with extrudates of desulfurization catalyst fluidized with mixtures of nitrogen and coal char/kerosene slurries are used to simulate the fluid dynamics of the H-Coal reactor at actual operating conditions. Data from these studies presented in Part I are used to establish the validity of a model giving the volume fraction occupied by the gas, the slurry, and the catalyst phase. The importance of bubble terminal velocity and solids holdup in the gas wake volume in explaining bed contraction is discussed.

13285 (DOE/ET/10618—T1) Kinetics and mechanisms of catalytic hydroliquefaction and hydrogasification of lignite. Quarterly report, April-June 1980. Weiss, A.H.; Kranich, W.L.; Gueruez, K. (Worcester Polytechnic Inst., MA (USA)). 25 Sep 1980. Contract AS01-77ET10618. 6p. NTIS, PC A02/MF A01.

Progress is reported in the research project aimed at investigation of the basic chemical kinetics and mechanisms in catalytic hydrogenation of lignite suspended in a carrier oil in a continuous reactor operating at steady state. Specifically, the research is designed to study the overall conversion rate and the elemental transformation from the raw materials into products under surface reaction cntrolling conditions and to postulate the reaction mechanisms of hydroliquefaction and hydrogasification of lignite based upon the results obtained. A delay of six months in the delivery of a new slurry pump has prevented extension of the range of available residence times in the continuous stirred tank reactor. A quick-feed mechanism installed on the batch autoclave permits more accurate determination of running times at constant temperature. A detailed study of decomposition of carrier oil (anthracene oil) sowed that gasification of the oil was considerably greater at high temperatures than previously expected. Future runs will be limited to conditions under which the carrier oil loss is a relatively small fraction of the oil generated from lignite.

13286 (DOE/ET/10744—T2) Investigation of the devolatilization of coal under combustion conditions. Eighth quarterly report for the period July 1, 1980 to completion of technical effort of contract. Seery, D.J. (United Technologies Research Center, East Hartford, CT (USA)). 1980. Contract AC01-78ET10744. 5p. NTIS, PC A02/MF A01.

This report describes progress in the study of pyrolysis of coal under combustion conditions. Major accomplishments have been: (1) utilization of the isothermal furnace to examine the effects of initial particle size and process temperature upon the rates and nature of light gas evolution in a one atmosphere reactor; and (2) determination of the sensitivity of tar yields and physiochemical characteristics to changes in ambient pressure.

13287 (DOE/ET/11030—T1) Shift conversion and methanation in coal gasification: bench-scale evaluation of a sulfur-resistant catalyst. Final report. Wood, B.J.; McCarty, J.G.; Sheridan, D.; Ablow, C.M.; Wise, H. (SRI International, Menlo Park, CA (USA). Materials Research Lab.). 24 Oct 1980. Contract AC21-78ET11030. 79p. NTIS, PC A05/MF A01.

The results of this study demonstrate that the Ir-promoted Ni/Al_2O_3 catalyst possesses several valuable and superior characteristics when used for catalytic methanation under typical industrial conditions. These properties include: higher activity by a factor of > 2 than that of the unpromoted Ni/Al_2O_3 catalyst; enhanced resistance to deactivation by hydrogen sulfide during exposure to contaminated feedstock, as manifested by the prolonged high methanation activity and extended service lifetime; and high resistance to carbon fouling.

13288 (DOE/ET/13395—7) Enthalpy measurement of coal-derived liquids. Quarterly technical progress report, October-December 1980. Kidnay, A.J.; Yesavage, V.F. (Colorado School of Mines, Golden (USA). Dept. of Chemical and Petroleum Refining Engineering). 15 Feb 1981. Contract AC22-79ET13395. 86p. NTIS, PC A05/MF A01.

Equipment modifications to the Freon flow system of a reference fluid boil-off calorimeter are described. These modifications, along with a new equipment start-up procedure, have resulted in enhanced system stability, and consequently, better accuracy in the measurements. A thorough check of equipment calibration and operation was conducted to assure the validity of the experimental data. Using the flow calorimeter, enthalpy measurements were made for 2,6-dimethylpyridine. The data were taken over a temperature range of 105 to 745°F along 50, 100, 200, 400, 576, 750, 1000, and 1500 psia isobars. Thermodynamic properties derived from the data were successfully compared to corresponding literature values. The measured quantities were also compared to those calculated from correlations using the SRK equation of state and a modification of the BWR equation of state by Kesler and Lee, and

there is good agreement. However, comparisons between measured and calculated quantities are limited by the lack of ideal gas heat capacity data.

13289 **(DOE/ET/14800—25) Exploratory research on solvent-refined coal liquefaction. Quarterly technical progress report, July 1-September 30, 1980.** (Pittsburg and Midway Coal Mining Co., Shawnee Mission, KS (USA)). Feb 1981. Contract AC22-79ET14800. 44p. NTIS, PC A03/MF A01.

Work continued on the study of disposable catalysts and the effect of specific additives in both the SRC I and SRC II processing modes. At 450°C, 2250 psig and 1.0 hour residence time with Loveridge coal in the SRC II mode, yields and hydrogen consumptions were essentially the same for runs with 5 wt % added pyrite or 3.3 wt % added ferric oxide. When Loveridge coal was impregnated with 0.7 wt % molybdenum, slightly higher oil yields and slightly lower hydrocarbon gas, SRC and IOM yields were obtained than with the iron compounds above. When Loveridge coal was processed in the SRC I mode at 450°C, 1900 psig and 26 minutes residence time, there was a 3.7% increase in total oil yield with a corresponding decrease in SRC yield when pyrite was added to the feed slurry. There was a smaller effect with a FeS_2/Fe_2O_3 combination and little or no effect when ferric oxide alone was added.

13290 **(DOE/ET/14809—5) Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Quarterly technical progress report, September 19-December 18, 1980.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 10 Jan 1981. Contract AC01-79ET14809. 29p. NTIS, PC A03/MF A01.

A 15% iron boride on SiO_2 catalyst was prepared using an alcohol solution reduction with $NaBH_4$. H_2 chemisorption measurements were performed for Fe-S-100 (3% Fe/SiO_2) and are in progress for the iron-boride-silica catalyst. Reduction of Co catalysts at 623 K rather than 723 K is being tested as a method to improve dispersion by decreasing the amount of Co-support interaction. An in depth study of non olefinic and nonparaffinic compound retention times on the 10% SP2100 chromotograph column has shown that the compounds elute in the following order for a specific carbon number: alkene < alkane < aldehyde < ketone < ester < alcohol < acid. Mass flow controllers have been installed in the reactor system and are fully operational.

13291 **(DOE/OR/03054—T4(App.C)) Kentucky Department for Natural Resources and Environmental Protection permit application for air contaminant source: SRC-I demonstration plant, Newman, Kentucky. Appendix C. Ambient monitoring report.** (International Coal Refining Co., Allentown, PA (USA)). 21 Nov 1980. Contract AC05-78OR03054. 314p. NTIS, PC A14/MF A01.

Baseline air quality and meteorology data collected at the proposed site in 1977 and 1978 are presented: sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, particles, lead, reduced sulfur compounds, and polycyclic aromatic hydrocarbons. (LTN)

13292 **(DOE/OR/13410—T1) Design, engineering, and evaluation of refractory liners for slagging gasifiers. Second annual technical progress report, 1 October 1979-30 September 1980.** Booth, G.; Firestone, R.F.; Greaves, M.J.; Hales, C.; Lamoureux, J.P.; Ledford, R.R. (IIT Research Inst., Chicago, IL (USA)). Oct 1980. Contract AC05-78OR13410. 169p. NTIS, PC A08/MF A01.

The program has been making steady progress to completion. The refractory liner test system is a much more complex design than originally proposed, but it is also safer and better able to simulate the actual coal gasification environment to which refractories will be exposed. Consequently, the data from the tests will be more reliable and the final handbook more useful for refractory liner design.

13293 **(DOE/PC/30075—2) Crossed reaction networks in the catalytic hydrodenitrogenation of synthetic liquid fuels. Quarterly report, May 1-July 31, 1980.** Satterfield, C.N.; Hsi, S. (Massachusetts Inst. of Tech., Cambridge (USA)). 1980. Contract AC22-80PC30075. 10p. NTIS, PC A02/MF A01.

We have constructed the gas feed control system, liquid feed system, the trickle bed reactor itself, a gas-liquid separator and sampling system, and automatic safety features. The physical construction of the whole system is nearly completed and we anticipate that it will be tested during the next quarter. The gas chromatograph, Perkin Elmer Sigma 1B, has been received and tested. The theoretical background for design of the laboratory trickle bed reactor is given in detail.

13294 **(DOE/PC/30232—T1) Pollutants from coal conversion processes. First progress report, September 1, 1980-February 28, 1981.** Ferrell, J.K.; Felder, R.M. (North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering). 1981. Contract FG22-80PC30232. 16p. NTIS, PC A02/MF A01.

Specific tests to be performed during the first year of research are listed: devise and test a procedure for the quantitative identification of the principal hydrocarbon and sulfur gas products of coal gasification in a reducing atmosphere; develop a procedure to measure trace quantities of nitrogen oxides in gasifier effluents; measure and model the kinetics of sulfur gas evolution in pyrolysis and gasification under carefully controlled laboratory conditions; measure and model the evolution of trace metal species during pyrolysis; and measure and correlate with a mathematical model emissions of sulfur gases, nitrogen oxides, and trace metals in the steam-oxygen gasification of coal. The first six months of the project have been devoted to assembling and testing of analytical equipment to measure sulfur gases, nitrogen gases, hydrocarbons, and trace metal element emissions in the pyrolysis and gasification of coal; and to further development of the gasification and pyrolysis reactors in use on the project.

13295 **(DOE/SF/10538—T2(Vol.1)) Advanced processes for metallurgical coke.** Straus, R.W.; Carsey, J.N.; von Bismarck, G.; Fujishima, C. (Galaxy, Inc., Washington, DC (USA)). Dec 1980. Contract AC03-79SF10538. 126p. NTIS, PC A07/MF A01.

This contract required Galaxy to examine overseas coking processes which can reduce the cost of metallurgical coke, while meeting pollution standards of the US. To approach this task properly, it was necessary to begin with a review of the basic data on the US steel industry. Experts tell Galaxy that over half of the US coke oven capacity is over or near retirement. This means replacement which has to be done in the face of a depressed industry. But it is necessary to compete with foreign steel producers who are going ahead with improvements. Thus, without new and more energy effective coke processes, which can cut cost, the US steel industry faces further recessions in the years ahead. The Japanese, the Germans, the French, and the Russians, as well as the US, are all conducting research on improved processes in the following categories: those which can use lower grades and cheaper coals as feedstocks; those which obtain higher energy efficiencies by recapturing heat now lost; those that will meet the increasingly stringent pollution control standards in the US; or processes, or combinations thereof, which reduce the coke rate per ton of steel. The advantages of the overseas processes are shown by the rather spectacular rise in US imports of coke which in less than a decade have risen from less than 200,000 tons to almost 4 million tons per year. The report details what the major countries, Japan, Germany, and France are doing, their expectations for reducing costs, using less costly coals, cutting emissions and developing auxiliary processes. Our experts agree that progress is evolutionary rather than revolutionary.

13296 **(DOE/SF/10538—T2(Vol.2)) Advanced processes for metallurgical coke. Appendices.** Straus, R.W.; Carsey, J.N.; von Bismarck, G.; Fujishima, C. (Galaxy, Inc., Washington, DC (USA)). Dec 1980. Contract AC03-79SF10538. 128p. NTIS, PC A07/MF A01.

Portions of document are illegible.

Material collected in a survey of German coking plants (most of it in German) is presented: coke for the German steel industry, recent developments suitable for retrofitting to existing coke ovens, German research and development programs in this area, automation, i.e., controlled and programmed operation, emission control from diffuse sources, such as charging parts, doors, etc. (LTN)

13297 **(DOE/SF/10538—T2(Vol.3)) Advanced processes for metallurgical coke. Appendices.** Straus, R.W.; Carsey, J.N.; von Bismarck, G.; Fujishima, C. (Galaxy, Inc., Washington, DC (USA)). Dec 1980. Contract AC03-79SF10538. 80p. NTIS, PC A05/MF A01.

Portions of document are illegible.

Material collected in a survey of German coking plants is presented (some in German; some in English): heat recovery in coke ovens and in coke cooling (both dry and wet methods); use of recovered heat to preheat charge, stamping techniques, blending coals, binders, briquetting, etc. (LTN)

13298 **(DOE/SF/10538—T2(Vol.4)) Advanced processes for metallurgical coke. Appendices.** Straus, R.W.; Carsey, J.N.; von Bismarck, G.; Fujishima, C. (Galaxy, Inc., Washington, DC (USA)). Dec 1980. Contract AC03-79SF10538. 104p. NTIS, PC A06/MF A01.

Portions of document are illegible.

Material collected in a survey of German coking plants (some in German, some in English) is presented: Ancit hot briquetting (including blast furnace tests), by-products of Ancit process, coal preparation, high volatile coking coals, preheating, briquetting blending, compacting and preheating, short coking time, wet charges, temperature control and heat consumption, supplies of coke, Solmer coke oven complex at Fos-sur-Mer, etc. (LTN)

13299 **(FE—1784-66) Program to discover materials suitable for service under hostile conditions obtaining in equipment for the gasification of coal and other solid fuels. Quarterly progress report, April 1, 1980-June 30, 1980.** Schaefer, A.O. (ed.). (Metal Properties Council, Inc., New York (USA)). 13 Nov 1980. Contract AC05-76ET10670. 208p. NTIS, PC A10/MF A01.

This Quarterly Progress Report describes a program under the direction of The Metal Properties Council, Inc., designed to screen materials for use in such plants with respect to the various unique corrosive environments obtaining therein; and, finally, to provide useful corrosion data as well as reliable information on other properties needed for the design, construction and operation of such plants. This program is sponsored by the US Department of Energy and the Gas Research Institute. In High Temperature Corrosion runs 54, 1650°F-0.5 v/o H_2O-10,000 hr, and 55, 1800°F-1.0 v/o H_2S-10,000 hr, were continued, and completed 9000 hr and 8000 hr of exposure, respectively, during the reporting period. Metallographic analysis of alternate alloy specimens exposed 1000 hr and 5000 hr in Run 54 was completed. Post-exposure analysis was completed for all HYGAS third-exposure test locations. A comparison of the corrosion data for the first three exposures was conducted. In Aqueous Corrosion ten 150-hr tests (345-354) were completed in the HYGAS 500 psi Design I environment. Stress-rupture testing of candidate alloys has been continued. Welded and unwelded specimens are being exposed at 1500°F to high pressure environments.

13300 **(FE—2270-72) Solvent Refined Coal (SRC) process operation of Solvent Refined Coal pilot plant, Wilsonville, Alabama. Quarterly technical progress report, January-March 1980.** (Catalytic, Inc., Wilsonville, AL (USA)). Feb 1981. Contract AC01-76ET10154. 142p. NTIS, PC A07/MF A01.

This report presents operating conditions and test results at the Solvent Refined Coal (SRC-I) pilot plant in Wilsonville, Alabama. Two coals from the Kentucky 9 seam (Lafayette mine and Dotiki mine) were processed. Hydrogen consumption, coal conversion and SRC yield were comparable when these coals were tested under similar conditions. Process solvent quality improved after the feed was switched from Lafayette to Dotiki coal. A vertical-leaf filter, manufactured by the United States Filter Corporation (USF), was used for solids separation during most of the Lafayette coal operations. The Kerr-McGee Critical Solvent Deashing (CSD) unit, which had been shut down for modifications since late 1979, was returned to service near the end of the Lafayette coal tests and remained on-stream during Dotiki coal processing. Using solution-annealed screens in the USF filter has eliminated the corrosion-related screen failures previously encountered. Cresol-insoluble material was very low, but ash in the filtered SRC product consistently exceeded the 0.16 wt % specification. The high-ash SRC product appears to have resulted from the presence of sodium carbonate, which was added to the coal slurry to prevent corrosion in the solvent recovery system. Recovery of SRC in the CSD unit ranged from 78 to 82 wt %. Deashing solvent losses averaged 4.9 wt % of the CSD feed.

13301 **(FE—2270-74) Solvent Refined Coal (SRC) process operation of Solvent Refined Coal pilot plant, Wilsonville, Alabama. Quarterly technical progress report, April-June 1980.** (Catalytic, Inc., Wilsonville, AL (USA)). Mar 1981. Contract AC01-76ET10154. 149p. NTIS, PC A07/MF A01.

This report summarizes the operating conditions and test results obtained at the six-ton-per-day Solvent Refined Coal (SRC) pilot plant in Wilsonville, Alabama. Kentucky 9 coal from the Dotiki mine was processed during Runs 204 through 208 and low-chlorine Kentucky 9 coal from the Fies mine was fed to the pilot plant during Runs 209 through 211. The objectives of operations were to determine the effect of: high pressure separator operation; changes to vacuum column operating temperature; light SRC addition; and chlorine content of coal on corrosion.

13302 **(FE—2893-60) EDS coal-liquefaction process development. Phase V. EDS commercial plant study design update, offsite design basis - Wyoming Coal Case.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Jan 1981. Contract AB01-77ET10069. 83p. NTIS, PC A05/MF A01.

The Wyoming Coal Case is being developed as a sensitivity to locating a commercial EDS plant in a northeast Wyoming location using the once-through liquefaction mode. Operating conditions in liquefaction are 840°F, 60 minutes nominal residence time at a solvent-to-coal ratio of 1.6/1. The Wyoming Coal Case of the SDU utilizes partial oxidation of about one half of the vacuum pipestill bottoms for hydrogen generation and FLEXICOKING of the remaining bottoms to make low Btu gas (LBG) for use as plant fuel. This configuration is essentially the same as used in the Illinois Coal Market Flexibility Sensitivity Case. The methane/ethane product will be sold as high Btu gas (HBG). HBG will also serve as backup fuel for the onsite area. The quality of the offsite design is to be equivalent to a screening quality study design. Wherever possible, the previous study designs are to be used to develop the offsite design for the Wyoming Coal Case. The offsite design effort will be concentrated on the water, fuel, steam and power systems and the wastewater treating facilities, and product shipping facilities. There will be minimum efforts (i.e., hold constant, prorate, or use judgment relative to the Illinois cases) on the remainder of the offsites.

13303 **(FE—2893-61(Summ.)) EDS coal-liquefaction process development. Phase V. EDS commercial plant study design update, Illinois Coal. Executive Summary.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Feb 1981. Contract AB01-77ET10069. 27p. NTIS, PC A03/MF A01.

This Executive Summary covers the conceptual, or study design of an Exxon Donor Solvent (EDS) Coal Liquefaction Commercial Plant feeding Illinois No. 6 bituminous coal. The EDS process directly converts coal to a range of clean hydrocarbon products. This is accomplished by contacting the coal with hydrogen in the presence of a hydrogenated solvent at about 840°F and 2000 psi. The study design explores the technical and economic issues which might be faced if an EDS commercial-size plant were to be designed on Illinois coal. It depicts the state of EDS technology in 1978, after approximately ten years of development work, as this technology might be applied in a commercial-size facility. Potential process improvements conceived after the design basis was set in 1978, such as liquefaction bottoms recycle and direct combustion of liquefaction bottoms, are not reflected here. Entitled the

Study Design Update (SDU), this conceptual design is a complete update of an earlier, less extensive study design prepared by the EDS Project in 1975/1976. The SDU was started in 1977, and technical work was completed in 1979; about 245 engineer-months of effort were expended. The objectives of the SDU were to identify the technical issues facing a potential commercial-size EDS plant design, to provide a reliable basis for estimating the cost of EDS products, and to furnish research guidance to the EDS Project. Also, the SDU was to provide a firm starting point for initial commercialization studies of a future pioneer liquefaction plant. These objectives were achieved.

13304 **(PB—80-175839) Potential of coal-based fuel and energy complexes: a regional appraisal. Summary status report, 1 June-30 September 1973.** Wen, C.Y. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). 1973. 5p. NTIS, PC A02/MF A01.

Reported is a project designed to develop suitable methodology for assessing the potential of various conversion technologies capable of utilizing coal in the Appalachian region to provide clean fuels and energy. Research involves development and use of engineering models for mining, conversion, and transmission in a systems evaluation. The integrated systems analysis, under constraints of resource availability and environmental quality, will permit economic criteria to form the basis for selecting technologies with the highest potential for the region. A review of literature sources provided information to establish the scope and extent of previous work. Six plant sites for study were selected on the basis of coal availability, water supplies, and topographically allowable space. Environmental and legal restrictions were also considered. Coal mining and processing are being studied, including conversion processes for coal utilization and the transmission of fuels and energy. In addition, process system analysis capabilities are being developed.

13305 **(PB—80-190796) Environmental assessment report: Wellman-Galusha low-Btu gasification systems. Final report May 78-Sep 79.** Murin, P.; Sipes, T.; Page, G.C. (Radian Corp., Austin, TX (USA)). May 1980. Contract EPA-68-02-2147. 309p. NTIS, PC A14/MF A01.

The report, an Environmental Assessment Report (EAR) for Wellman-Galusha low-Btu gasification systems, is part of an overall environmental assessment program for low-medium-Btu gasification technology. This EAR provides EPA administrators and program offices with a document representing the Office of Research and Development's (ORD's) research input to standards support for Wellman-Galusha gasification facilities. This EAR is a detailed evaluation and presentation of process, control, and waste stream data collected from field tests, open literature, vendors, process licensors, and computer modeling. It gives an overview of Wellman-Galusha gasification systems, including estimates of the systems' energy conversion efficiencies and capital and operating costs. It provides data characterizing the systems' input materials, process streams, products, byproducts, and multimedia discharges. It identifies pollution control alternatives for the multimedia discharges and toxic substances in the systems' products and byproducts, and estimates their costs and energy impacts. It assesses regulatory requirements for the environmental impacts of the systems. It gives data needs and recommendations for obtaining those data, and discusses the EPA program office issues and areas of concern for the Wellman-Galusha low-Btu gasification technology.

13306 **(PB—80-193618) Detailed control technology survey of a coke oven plant. Survey report.** Sheehy, J.W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). Jul 1979. 36p. NTIS, PC A03/MF A01.

This report describes the results of a coke oven control technology field survey at a fully integrated steel plant. The study's four major objectives were: (1) Evaluate coal shoveling practices by benchmen; (2) test a sampling approach for evaluating door emission controls; (3) evaluate filter air systems in the worker lunchroom and larry car cab; and (4) determine effect of meteorological conditions, such as wind speed and direction, on coke battery CTPV concentrations.

13307 **(SAND—80-1751C) Catalysts in coal liquefaction.** Thomas, M.G. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 10p. (CONF-810315—3). NTIS, PC A02/MF A01.

From 8. energy technology conference and exposition; Washington, DC, USA (9 Mar 1981).

Currently, catalysts are utilized in coal liquefaction for upgrading of initially dissolved products and refining. Emphasis is on the production of the secondary and finished products only. This function, and the catalysts currently used, is the result of many years of experience in the petroleum industry. It is highly unlikely, therefore, that any major breakthrough for coal liquefaction will be made in terms of catalyst development as long as catalysts are used primarily for these purposes. There are, however, major process modifications that could ultimately result if catalysts were tailored for, and utilized prior to, upgrading in a more integrated approach. Improved hydrogen-transfer functionality is the key to easing temperature and pressure constraints. It is not clear that conventional hydrodesulfurization or hydrodenitrogenation is paramount for the early stages of coal liquefaction, although they are clearly required in upgrading. Other catalysts may be much more effective in transferring hydrogen from the solvent to the coal-derived products. In summary, catalysts are used but are not absolutely necessary for direct coal liquefaction. Current technology utilizes catalysts primarily for upgrading and refining, relying on thermal chemistry for most of the initial reaction. Major process modifications due to catalysis are not likely under this constraint. In the absence of this limitation, we could utilize the effects that catalysts have on the initial chemistry of coal liquefaction, and these effects could provide significant process improvements.

13308 **(UCID—18941) Tono-1 field experiment preliminary process design.** Hill, R.W.; Thorsness, C.B.; Thompson, D.S.; Cena, R.J.; Shannon, M.J.; Stephens, D.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Feb 1981. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01.

A decision has been made by DOE to initiate an in situ coal gasification project in the State of Washington at a site in the Tono basin owned by Washington Water Power Company. This site has been surveyed and partially characterized by a team led by Sandia National Laboratory, Albuquerque. The program, envisioned for this project, is to complete the site characterization, to do a short series of large scale laboratory type experiments called Large Block Tests at a site in the Widco mine and to carry out two field experiments, the first Tono-1 based on directional drilling and the second Tono-2 based on reverse combustion linking.

13309 **(UCID—18944) Large block tests: experimental plan.** Hill, R.W.; Thorsness, C.B.; Thompson, D.S.; Cena, R.J.; Shannon, M.J.; Stephens, D.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Feb 1981. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01.

Small scale tests in the laboratory with forward combustion in blocks of coal have provided some useful insights into the very early stages of cavity growth in different coal types. However, the scale is too small to allow for realistic extrapolation to field tests. A natural extension to larger blocks, perhaps 20 feet or more on a side is needed. The tests proposed in this report will be conducted in an unused portion of an open pit coal mine at an exposed coal face. The basic objective of the large block experiments is to quantify the early time cavity growth at a scale large enough to allow safe extrapolation to field situations. The specific goals are: (1) to determine the burn cavity shape and degree of rubble fill for a coal consumption of approximately 30 m^3; (2) to determine the gas composition and particulate production as a function of operating conditions through the burn; (3) to observe linking channel growth due to hot gas flow; (4) to observe the extent of slag formation from parting zones and coal ash and determine any interactions with the burn process; and (5) to determine any significant differences in cavity growth or process behavior due to changes in oxygen/steam ratio.

13310 **(UCRL—53082) Steam tracer experiment at the Hoe Creek No. 3 underground coal gasification field test.** Thorsness, C.B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Nov 1980. Contract W-7405-ENG-48. 49p. NTIS, PC A03/MF A01.

Water plays an important role in in-situ coal gasification. To better understand this role, we conducted a steam tracer test during the later stages of the Hoe Creek No. 3 underground coal gasification field test. Deuterium oxide was used as the tracer. This report describes the tracer test and the analysis of the data obtained. The analysis indicates that at Hoe Creek the injected steam interacts with a large volume of water as it passes through the underground system. We hypothesize that this water is undergoing continual reflux in the underground system, resulting in a tracer response typical of a well-stirred tank.

13311 **H-Coal Kentucky Plant.** Hoertz, C.D. Jr. (Ashland Oil, Inc., KY). pp 14p, Set No. 9, Paper 2 of Session papers presented at the 1980 American Mining Congress international coal show. Washington, DC; American Mining Congress (1980).

From American Mining Congress international coal show; Chicago, IL, USA (5 May 1980).

The Catlettsburg, KY facility will be the last step necessary to establish technical and economic feasibility of the H-Coal process and provide design data for a commercial plant. The H-Coal process is a development of Hydrocarbon Research, Inc. (HRI). It converts coal by catalytic hydrogenation to substitutes for petroleum ranging from a low sulfur fuel oil to distillate synthetic crude, the latter representing a potential source of raw material for the petrochemical industry. Development began over 14 years ago, progressing through bench scale and process development stages to the pilot plant at Catlettsburg which has a design capacity of 600 TPD. The process is related to HRI's H-Oil process which is used commercially for the desulfurization of residual oils from crude oil refining. Depending upon the mode of operation, the pilot plant will produce varying quantities of liquid products ranging from propane to residual fuel as well as significant quantities of gaseous fuel. Briefly, coal is cleaned, dried, pulverized and slurried with process-derived oil in the preparation section. It is then pumped to reactor pressure, mixed with hydrogen, heated, and charged to the reactor. There the coal, recycle oil and hydrogen react in the presence of a catalyst at pressures up to 3500 psig and temperatures to 850°F. After leaving the reactor, the liquid effluent is treated to provide a low-solids recycle oil which is used to slurry the coal. The balance of the liquid is fractionated into distillate products and ash-containing residuum.

13312 **Exxon donor solvent coal liquefaction process: development program status.** Epperly, W.R.; Plumlee, K.W.; Wade, D.T. (Exxon Research and Engineering Co., Florham Park, NJ). pp 28p, Set No. 9, Paper 3 of Session papers presented at the 1980 American Mining Congress international coal show. Washington, DC; American Mining Congress (1980).

From American Mining Congress international coal show; Chicago, IL, USA (5 May 1980).

The integrated approach to the development of the EDS process involves optimum use of the laboratory and engineering R and D programs, the 250 T/D pilot plant, and the 70 T/D FLEXICOKING prototype to obtain the data for a commercial design. The design data for the key development areas, e.g., slurry drying, liquefaction, distillation, solvent hydrogenation, FLEXICOKING, product quality, and environmental control, will be obtained in the most appropriate project area at the minimum development cost. For example, the role of the ECLP (250 T/D) pilot plant and FLEXICOKING prototype in the EDS Project is to provide operability and design data in the slurry drying, liquefaction, distillation and bottoms processing areas. ECLP was sized so that the limiting pieces of equipment (e.g., coal slurry preheat furnaces and liquefaction reactors) are the minimum size that will allow confident scaleup to a commercial size plant. Other critical areas include environmental control, feed slurry drying, slurry pumping, high pressure letdown valves and vacuum bottoms pumping. The FLEXICOKING prototype unit was sized to provide scaleup data on the fluid bed operation, product quality data, and environmental control data. The prospects for successfully developing coal liquids technology with the programs presently in place are good, but the prospects and timing for an economically attractive coal liquids industry are uncertain.

13313 **(PB—80-206238) Energy and entropy fluxes in coal gasification and liquefaction processes. Final report.** Voigt, H. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 28p. NTIS PC E03/MF E03.

Coal conversion systems are rather complex, not only internally but also with respect to their exchanges with the environment, some use auxiliary energy, others yield by-products. Therefore, the evaluation of such systems is not a simple task and the comparison of very different systems--different in the nature of inputs and outputs--must not be reduced to a comparison of energy efficiencies. Moreover, because these studies cover a long time period it is necessary to estimate the potential development of related processes in order to determine the inputs required for producing substitute fuels. There are physical and chemical limitations to potential improvement. This paper outlines these constraints and provides means for the evaluation and comparison of different fuel synthesis processes, especially regarding methanol. The possibility of adding energy from nuclear or solar primary energy sources to such processes is discussed and the advantages are assessed. (Copyright (c) 1980 International Institute for Applied Systems Analysis.)

0106 Properties

13314 **(DOE/ET/10560—T1) Study of the mineral matter distribution in pulverized fuel coals with respect to slag deposit formation in boiler furnaces. Phase 1. Final report, 1 April 1976-30 June 1980.** Austin, L.G..; Moza, A.K.; Abbott, M.F.; Singh, S.N.; Trimarchi, T.J. (Pennsylvania State Univ., University Park (USA). Dept. of Materials Science and Engineering). Jul 1980. Contract AS22-76ET10560. 292p. NTIS, PC A13/MF A01.

The work reported here is aimed at understanding the initiation of upper wall slag deposits in pulverized coal fired utility boilers, and characterizing pulverized coals for the mineral elements of significance. A scanning electron microscope with x-ray fluorescence capability, under computer control, has been used to analyze individual coal particles for the elements Si, Al, Ca, Fe and S. The required software for these analyses has been developed, as have suitable sample preparation techniques. The results show many different types of particles to exist in pulverized coal, some of which are likely to be bad-acting in terms of slagging. A test has been developed to study the sticking of melted pellets of ash or mineral matter dropped onto a metal substrate held at a controlled temperature. It was found that for a given drop composition and substrate material there is a substrate temperature below which the drop will not adhere. At higher substrate temperatures the strength of adhesion increases logarithmically. Sticking appears to be a function of the oxidation of the surface or of alkalies deposited on the surface. If the drop composition is such that material absorbed from the substrate fluxes the drop-substrate interface, then the apparent contact angle is reduced and sticking is enhanced, and vice-versa. A small-scale pulverized coal furnace designed to give a uniform temperature-time history for each particle was reconstructed and tested. Water-cooled probes were found to give the most accurate control of initial probe temperature. Deposits initiate on the probe in a few minutes, and the fall of probe temperature can be used to indicate the growth of deposit. Systematic investigation of the particles initiating the deposit have not yet been performed.

13315 **(DOE/PC/20095—T1) Coal-fluid properties. Final report.** Klinzing, G.E. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1979. Contract AC22-79PC20095. 121p. NTIS, PC A06/MF A01.

The study of the settling of glass-oil systems was carried out in an effort to determine factors influencing the settling of coal-oil mixtures. Using the diffusion theory of Smiles to analyze new glass-oil data and previously taken coal-oil mixture sedimentation results proved successful. The diffusivity and initial settling rate expressions can be used to classify the stability of the systems studied as well as COMs. The shape of the settling particles affects the sedimentation process. Angular particles settle approximately two times slower than spherical particles. Settling interfaces have been estab-

lished in reference to solids concentrations. The diffusivity was found to decrease with decreasing temperature particle size, initial heights and solids concentrations.

13316 **(EGN—89) Chemical and biological characterization of leachates from coal solid wastes.** Griffin, R.A.; Schuller, R.M.; Suloway, J.J.; Shimp, N.F.; Childers, W.F.; Shiley, R.H. (Geological Survey, Champaign, IL (USA)). Nov 1980. 109p. Geological Survey, Champaign, IL.

Eleven coal solid wastes were characterized chemically and mineralogically. The wastes comprised three Lurgi gasification ashes, mineral residues from the SRC-I and H-Coal liquefaction processes, two chars, two coal-cleaning residues, and a fly ash and water-quenched bottom ash (slag) from a coal-fired power plant. Leachates that were generated from the solid wastes at four pH levels and under two different gas atmospheres were analyzed for more than 40 chemical constituents. These leachates were also used in soil attenuation studies and in acute 96-hour static bioassays using fathead minnow fry. Sixty constituents were determined in the solid wastes. A range of 2 to 13 in the aqueous extracts generated in the laboratory from the individual wastes exceeded minimum standards of water quality recommended by the federal government. The most significant mineral transformations that occurred during coal conversion processing were those of the iron-bearing minerals. Thermodynamic speciation of inorganic ions and complexes in solution was modeled using the computer program WATEQF. Study of the soil attenuation of soluble constituents leached from the coal solid wastes used the dispersed soil method with three Illinois soils of widely varying character. The results showed that chemical constituents were attenuated by the soils to a high degree. The results of 96-hour static bioassays indicated that the water-soluble constituents in equilibrium with the wastes generally were not acutely toxic to fathead minnow fry at near neutral pH's (7.0 to 8.5); however, there was complete mortality in both the high- and low-pH leachates.

13317 **(LA—8369-PR) Catalytic coal conversion support: use of laser flash-pyrolysis for structural analysis. Progress report, September 1-December 31, 1979.** Verzino, W.J. Jr.; Vanderborgh, N.E.; Fletcher, M.A.; Nichols, B.A. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01.

The gaseous products observed from the neodymium laser pyrolysis of coal appear to be generated out of the highly energetic plasma. Neodymium laser pyrolysis in helium, hydrogen, or deuterium atmospheres did not affect the product distribution. Deuteration of the pyrolysis products was observed when deuterium was used as the carrier gas. High speed photography visualized the explosive interaction of the neodymium laser beam with the coal pellet. The plasma generated during this event and its direction of propagation are clearly shown. Similar gaseous pyrolysis products are observed with neodymium laser pyrolysis of five different ranks of coal. Laser pyrolysis with a continuous wave CO_2 laser produced a significantly larger number of components than did the neodymium laser. There is little similarity between the pyrolysis products obtained with the neodymium and those obtained with the continuous wave CO_2 laser.

13318 **(ORNL/MIT—305) Modeling of gas sorption kinetics in coal.** Irwin, T.B.; Grosset, A.M.; Sood, J.S. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 65p. NTIS, PC A04/MF A01.

Transient and equilibrium sorption characteristics of water on Texas lignite coal were measured in the pressure range of 1.2 to 2.3 kPa water pressure. In comparing the current work with that of previous investigators, it was found that only the current study achieved a close approach to equilibrium. Of the several modeling procedures attemped, a model proposed by Debelak, combining Fickian diffusion and adsorption, provided the firmest theoretical ground as well as reasonably good correlation. A mass-action kinetic approach gave excellent correlation. Simple Fickian diffusion and an empirical first-order mode were less successful.

0108 Waste Management

REFER ALSO TO CITATION(S) 13316, 13365, 14277, 14447, 14591, 14698, 14763, 14776

13319 **(ARI-RP—64) Homogeneous production and removal of NO/sub x/ from combustion exhaust flows. Second quarterly technical summary report, November 1, 1980-January 31, 1981.** Silver, J.A. (Aerodyne Research, Inc., Bedford, MA (USA). Center for Chemical and Environmental Physics). Feb 1981. Contract AC21-80MC14737. 25p. NTIS, PC A02/MF A01.

The addition of ammonia to the exhaust stream of stationary combustors is a promising approach toward reducing NO/sub x/ emissions. The use of high sulfur-content fuels will produce moderate quantities of SO_2 and other sulfur-bearing compounds which may affect the effectiveness of this thermal deNO/sub x/ process. Initial modeling efforts indicate that the presence of SO_2 is slightly beneficial in removing NO near 1250°K. In addition, experiments show that the ammonia species (NH/sub i/, i=1,2,3) do not directly form NO upon reaction with SO_2. Other products of these reactions are currently being measured.

13320 **(CONF-810203—6) Direct acid dissolution of aluminum and other metals from fly ash.** Kelmers, A.D.; Egan, B.Z.; Seeley, F.G.; Campbell, G.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01.

From AIME annual meeting; Chicago, IL, USA (22 Feb 1981).

Fly ash could provide a significant domestic source of alumina and thus supply a large part of the US needs for aluminum and possibly also several other metals. The aluminum and other metals can be solubilized from fly ash by acid dissolution methods. The aluminum may be present in any or all of three solid phases: (1) crystalline; (2) glassy amorphous; and (3) irregular, spongy amorphous. The chemistry of these phases controls the solubilization behavior. The aluminum in high-calcium western ashes is primarily found in the amorphous phases, and much of it can be solubilized by using short-time, ambient-temperature leaching. Little of the aluminum in the low-calcium eastern ashes is solubilized under ambient-temperature conditions, and only a portion can be solubilized even at reflux temperature conditions. Some of the aluminum in these eastern ashes is present as mullite, while some is found in the amorphous material. The fraction contained in mullite is relativey acid insoluble, and only partial solubilization can be achieved even under vigorous acid leach conditions.

13321 **(DOE/GFETC/RI—80/6) Activated carbon adsorption from a high TOC wastewater.** Hird, K.B.; Kube, W.R.; Schobert, H.H. (Department of Energy, Grand Forks, ND (USA). Grand Forks Energy Technology Center). 1980. 19p. NTIS, PC A02/MF A01.

The ability of activated carbon to reduce total organic carbon in highly concentrated wastewaters from a coal gasification pilot plant was evaluated in laboratory batch and column tests. The wastewater initially contains over 5000 mg/l TOC, largely phenols and cresols, with numerous other organic species in much lower concentrations. The physical adsorption process is best explained by the Freundlich model, with the slope and intercept of the Freundlich isotherm comparable to data reported for treatment of refinery wastes. Carbon exhaustion rates and bed depth-service time curves are also comparable to refinery treatment data obtained from waters of lower TOC or COD. Laboratory-scale column tests reduced TOC from 5740 mg/l to 200 mg/l.

13322 **(PB—80-176605) Big Sky coal mine - a mine-site study of benefits and costs of reclaiming surface-mined land in the west. Part III.** Julian, E.L. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Economics). 1979. 202p. NTIS, PC A10/MF A01.

The benefit-cost ratio of western coal reclamation is examined. Rising prices of imported crude oil have spurred significant expansion of western coal production to increase domestic sources of energy. This in turn has raised concerns about environmental impacts with resultant state laws requiring reclamation of mined land.

Standard benefit-cost analysis studies provide insight into the absolute and relative size of benefits and costs of reclaiming surface mined western coal land using a case study of the Big Sky Mine in southeast Montana. This report presents the project's rationale, problems, and objectives. Several analyses of benefits and costs of reclamation are reviewed. The environment at Big Sky Mine is described and the laws and regulations affecting the mine are cited. Procedures and costs of reclamation at the mine are discussed, and the valuation methodologies of outdoor recreation and recreational benefits are examined and estimated. Benefits and costs are compared with respect to both priority and social benefits. The summary, conclusion, and implications of the research are presented.

13323 **(PB—80-181134) Treatability and assessment of coal conversion wastewaters. Phase I. Final report, September 1978-September 1979.** Singer, P.C.; Lamb, J.C. III; Pfaender, F.K.; Goodman, R. (North Carolina Univ., Chapel Hill (USA). Dept. of Environmental Sciences and Engineering). Nov 1979. 194p. NTIS, PC A09/MF A01.

The report gives Phase I results of (1) an assessment of the environmental impact of wastewaters originating from the production of synthetic fuels from coal, and (2) an evaluation of alternative technologies for treating these wastewaters. Work on coagulation, adsorption, and preliminary biological treatment studies is continuing. The major focus is on aerobic biological treatment which is projected to be the principal means of removing organic impurities from these wastewaters and a cornerstone of any overall wastewater treatment program. A synthetic wastewater, designed to simulate a real conversion process wastewater, was fed to a series of aerobic biological reactors. Design and operation of the reactors is described, along with performance data spanning two 6-month operating periods.

13324 **(PB—80-181589) Soil genesis, hydrological properties, root characteristics and microbial activity of 1- to 50-year old stripmine spoils. Final report, October 1975-June 1978.** Schafer, W.M.; Nielsen, G.A.; Dollhopf, D.J.; Temple, K. (Montana State Univ., Bozeman (USA). Agricultural Experiment Station). Apr 1979. 233p. NTIS PC MF A01.

Reclamation of coal strip-mined land is a major environmental concern. The future of reclaimed land depends on the long-term stability of the soil-vegetation system on mined land. To evaluate some of the possible changes that occur in mine soils through time; soil genesis, water flow patterns, root development, and microbial activity were studied on natural soils and 1- to 50-year-old mine soils. Similar soil development processes occur in both minesoils and natural soils, but because mine soils have a different origin, they will probably always remain different than natural soils. Differences in water flow patterns on minesoils and natural soils were attributed to plant community and soil textural differences.

13325 **(PB—80-188402) Experimental/engineering support for environmental protection agencies fluidized-bed combustion (fbc) program: final report. Volume I. Sulfur oxide control. Final report Dec 75-Dec 78.** Ulerich, N.H.; Vaux, W.G.; Newby, R.A.; Keairns, D.L. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Jan 1980. Contract EPA-68-02-2132. 246p. NTIS, PC A11/MF A01.

The report gives results of an investigation of the desulfurization performance and attrition behavior of limestone and dolomite sorbents for atmospheric and pressurized fluidized-bed combustion (FBC) systems used with coal. It gives results of experimental thermogravimetric analyses (TGAs) of the kinetics of SO2 capture by sorbents, and discusses the further development and application of a kinetic model for desulfurization, based on TGA results. It also gives results of a basic assessment of sorbent attrition mechanisms in FBC, including some laboratory experimental tests. Some conclusions from this work are: (1) pressurized FBC systems can achieve effective SO2 removal at high temperatures (1000 C) or high excess air (300%) without an increase in sorbent requirements over lower temperature/excess air cases; (2) the agreement between actual FBC data and the TGA-based desulfurization model has been further demonstrated, using data from both atmospheric and pressurized FBCs; and (3) sorbent attrition screening tests indicate that sorbent type and FBC operating parameters will affect particle attrition. The report presents an experimental-data-supported sorbent attrition model for the bubbling bed regime in an FBC.

13326 **(PB—80-191281) Sampling and analysis of reduced and oxidized species in process streams. Final report Jul 76-Aug 79.** Maddalone, R.F.; Scinto, L.L.; Yamada, M.M. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). Nov 1979. Contract EPA-68-02-2165. 229p. NTIS, PC A11/MF A01.

The report gives results of a program of over 60 tasks involving the evaluation, development, testing, and field adaptation of measurement techniques for elemental analysis and inorganic compound identification in process and effluent streams. Procedures for particulate sampling at the inlet and outlet of FGD systems were developed. Methods for H_2SO_4 sampling in flue gas streams were developed based on the controlled condensation of H_2SO_4 vapor (a manual procedure was used as the basis for an automated H_2SO_4 monitoring instrument that was built and tested). Two procedure manuals were written for reduced and oxidized inorganic species. The reduced species manual detailed GC and GC/MS procedures for identifying organometallic compounds as well as homologous series such as RSH and RNH. The oxidized species were identified using an integrated series of analytical methods such as AAS, ICAP, XRD, FTIR, ESCA, and SEM-EDX. The procedures developed, applied to samples from several EPA programs, showed that the analysis scheme is applicable to most solid samples from combustion sources. Ion chromatographic procedures were also developed for analyzing FGD system slurry streams. The use of pH and chloride electrodes for controlling FGD systems was investigated. The methodology for coal flow monitors was reviewed.

13327 **(PB—80-196314) Definitive sox control process evaluations: limestone, lime, and magnesia FGD processes. Final report Jun 78-Sep 79.** Anderson, K.D.; Barrier, J.W.; O'Brien, W.E.; Tomlinson, S.V. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Emission Control Development Projects). Jan 1980. 327p. NTIS, PC A15/MF A01.

The report gives economic and ground-to-ground energy evaluations of limestone slurry, lime slurry, and magnesia (producing sulfuric acid) flue gas desulfurization (FGD) processes. The lime slurry process, using purchased lime and lime calcined onsite, remains lower in capital investment (90 $/kW for the base-case 500-MW power plant burning 3.5% sulfur coal) than the limestone slurry process (98 $/kW). The limestone slurry process remains lower in annual revenue requirements (4.02 mills/kWh) than the lime slurry process (4.25 mills/kWh). The magnesia process is about one-third higher in capital investment (132 $/kW) and one-fourth high in annual revenue requirements (5.05 mills/kWh including credit for acid sales) than the limestone slurry process, because of absorbent-recovery and acid-producing complexities. The lime slurry process using purchased lime is more economical than the limestone slurry process at low absorbent consumption rates (below about 200 MW or 2% sulfur coal). Onsite lime calcination becomes economical compared to purchased lime for larger power plants and higher coal sulfur levels (about 1000 MW with 3.5% sulfur coal, 750 MW with 5% sulfur coal). The limestone slurry process has the lowest overall (raw material, FGD, and disposal) energy requirements (26% less than lime and 30% less than magnesia).

13328 **(PB—80-197072) Control assay development: methodology and laboratory verification. Final report, July 1978-July 1979.** Longaker, W.F.; Hossain, S.M.; Cherry, A.B. (Catalytic, Inc., Philadelphia, PA (USA)). Jan 1980. Contract EPA-68-02-2167. 141p. NTIS, PC A07/MF A01.

The report describes Control Assay Development (CAD), a data acquisition program designed to evaluate the potential applicability of various treatment processes for the control of solid, liquid, and gaseous emissions from coal conversion plants. The CAD program described could be used to provide data for evaluating selected treatment technologies for coal conversion wastewaters. Detailed descriptions of all CAD screening procedures and equipment required for outfitting a mobile laboratory are presented. Laboratory tests were conducted to assess the adequacy of the proposed designs and operating procedures, and to verify the use of a dry bacterial culture for biological oxidation studies. A number of design modifications were recommended, based on the laboratory

tests. Insufficient benefit is derived from the use of a dry bacterial culture during the bio-oxidation screening procedure to warrant its adoption in the testing procedure.

13329 **Control technology for coal cleaning wastes.** Wangen, L.E.; Bertino, J.P.; Jones, M.; Wagner, P.; Wanek, P.L.; Wewerka, E.M.; Williams, J.M. (Los Alamos Scientific Lab., NM). pp 79-91 of Solid waste research and development needs for emerging coal technologies. New York, NY; American Society of Civil Engineers (1979).

From American Society of Civil Engineers Power Research Council/Electric Power Research Institute workshop; San Diego, CA, USA (23 Apr 1979).

Coal cleaning is receiving increased attention of late as a means of reducing the sulfur content of coal pursuant to air quality regulations. Wastes from such processes are often, themselves, a source of potential environmental pollutants. Research at the Los Alamos Scientific Laboratory (LASL) has identified trace element contamination in coal refuse leachate. The degree of this contamination is largely determined by the quantity of oxidized, acid producing pyritic materials in the refuse. Because of this highly contaminated leachate, coal refuse disposal presents a serious challenge for those involved in pollution control technology. This paper summarizes LASL studies into the technical feasibility of various methods for reducing or preventing the release of trace elements from coal cleaning wastes. Calcining, cementing, akaline neutralization by lime or limestone and addition of overburden or utility process stream wastes are shown to be potentially useful for the control of trace elements by laboratory scale experiments. Results of these experiments are presented and some economic analyses of the various options are discussed.

0109 Environmental Aspects

13330 **(PB—80-184534) The direct use of coal. Volume II-part C: working papers. Appendices X thru XIV.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Dec 1979. 542p. NTIS, PC A23/MF A01.

The contents include: (1) Effects on plants of sulfur pollutants from coal combustions; (2) Coal mine health; (3) Social and economic impacts of coal production in the Eastern United States; (4) Impacts of coal development of Western communities; and (5) Public attitudes toward coal-fired power plants.

13331 **(PB—80-187941) Direct-seeding of commercial trees on surface-mine spoil. Final report.** Graves, D.H.; Carpenter, S.B.; Wittwer, R.F. (Kentucky Univ., Lexington (USA). Dept. of Forestry). Apr 1980. 18p. NTIS, PC A02/MF A01.

Two small-seeded species, Paulownia (Paulownia tomentosa), and European alder (Alnus glutinosa) and three large seeded species, northern red oak (Quercus rubra), pin oak (Quercus palustris), and bur oak (Quercus macrocarpa) were direct-seeded on three aspects on minesoil in eastern Kentucky. Treatments included four mulch applications--water-borne fiber mulch, hardwood bark, bark and manure, and composted municipal waste; and two fertilizer applications. Growth and survival were evaluated during two consecutive growing seasons.

13332 **(PB—80-188121) Miniplant and bench studies of pressurized fluidized-bed coal combustion: final report. Report for Aug 77-Aug 79.** Hoke, R.C.; Matulevicius, E.S.; Ernst, M.; Goodwin, J.L.; Garabrant, A.R. (Exxon Research and Engineering Co., Linden, NJ (USA)). Jan 1980. Contract EPA-68-02-1312. 333p. NTIS, PC A15/MF A01.

The report gives further results of studies on the environmental aspects of the pressurized fluidized-bed coal combustion process, using the 218 kg coal/hr continuous combustion/sorbent regeneration Miniplant (0.63 MW equivalent), and a 13 kg coal/hr bench-scale system.

13333 **(PB—80-190994) Mathematical model of electrostatic precipitation (revision 2). Report for Jan 76-Dec 78.** Mosley, R.B.; Anderson, M.H.; McDonald, J.R. (Southern Research Inst., Birmingham, AL (USA)). Feb 1980. Contract EPA-68-02-2193. 402p. NTIS, PC A18/MF A01.

The report describes modifications to the EPA/Southern Research Institute computer model of electrostatic precipitation (ESP). The modifications include a new semi-empirical approximation procedure for predicting electrical conditions in an ESP. Comparisons between the results from the approximation procedure and more exact procedures are presented. A new integration procedure for calculating particle charge is also presented. Complete Fortran listings of the revised ESP model and the new subprograms are provided. Example problems are included. The modified model requires significantly less computer time than does the earlier model. Comparisons of results obtained using the earlier and the modified models over a wide range of possible ESP geometries and electrical operating points indicate that for practical purposes the modified model can be used in place of the more rigorous earlier model.

13334 **(PB—80-192206) Illinois environmental issue: water resources and coal mining.** (Illinois Environmental Protection Agency, Springfield (USA)). 1979. 21p. NTIS, PC A02/MF A01.

A partial listing of topic areas includes: Development of Illinois coal mining; Mine area water resource protection; IEPA actions encouraging development of Illinois coal.

13335 **(PB—80-193212) Environmental assessment of dry coke quenching vs. continuous wet quenching. Final report Sep-Oct 79.** Westbrook, C.W.; Coy, D.W. (Research Triangle Inst., Research Triangle Park, NC (USA)). May 1980. Contract EPA-68-02-3152. 40p. NTIS, PC A03/MF A01.

The report gives results of an assessment of the multimedia environmental impacts of continuous wet and dry quenching at National Steel's Weirton, West Virginia, Brown's Island coke plant. The report, based primarily on design data, test data from related processes, and engineering judgement, suffers from the lack of definitive test data. The assessment indicates that dry coke quenching results in less particulate matter emitted, less solid waste generated, less process-related gas emitted, and potentially less emission of polynuclear aromatic hydrocarbons and organics in general, than wet quenching. Dry coke quenching also results in increased aqueous effluents and fugitive emissions from coke transport and screening. The assessment concludes that, with proper wastewater treatment and control of coke transport emissions, the dry quench process should have less negative environmental impact than continuous wet quenching. The report identifies areas where data are insufficient for Level 1 assessment and indicates the testing required for a complete Level 1 assessment.

13336 **(PB—80-194319) Environmental effects of western coal surface mining. Part VI: smallmouth bass and largemouth bass in the Tongue River Reservoir, Montana, 1975-76. Final report.** Penkal, R.F.; Gregory, R.W. (Montana Cooperative Fishery Research Unit, Bozeman (USA)). May 1980. 57p. NTIS, PC A04/MF A01.

Population parameters of smallmouth bass (Micropterus dolomieui) and largemouth bass (M. salmoides) were studied during 1975 and 1976, before expansion of surface coal mining adjacent to the Tongue River Reservoir in southeastern Montana. Reproductive success, as determined by alongshore seining, varied in different areas of the reservoir and may be correlated to turbidity. Population estimates were obtained at night during spring and fall 1976 with boat electrofishing gear. For yearling and older smallmouth bass the fall population of 13.0 fish/ha and the standing crop of 2.03 kg/ha represented 80 and 84 percent of the totals for basses in the reservoir. The largemouth bass population and standing crop during fall 1976 was 3.2 fish/ha and 0.32 kg/ha.

13337 **(PB—80-198245) Environmental effects of western coal surface mining. Part VII. Microbial effect on the quality of leach water from eastern montana coal mine spoils. Final report.** Kimble, P.F.; Temple, K.L. (Montana State Univ., Bozeman (USA). Dept. of Microbiology). May 1980. 91p. NTIS, PC A05/MF A01.

Selected portions of test cores from the overburden of the West Moorhead coal deposit in southeastern Montana were examined for possible addition to leach water of toxic substances and for the presence of iron and sulfur bacteria which might contribute to leaching. Leachates were evaluated by measuring pH, lead, and the effect of the leachates on the Selenastrum algal assay.

0120 Mining

REFER ALSO TO CITATION(S) 13304, 13367, 13371, 13375, 13409, 14197

13338 **(CONF-790894—) First conference on ground control problems in the Illinois Coal Basin: proceedings.** Chugh, Y.P.; Van Besien, A. (eds.). (Department of Energy, Carbondale, IL (USA). Carbondale Mining Technology Center; Southern Illinois Univ., Carbondale (USA). Dept. of Mining Engineering). Jun 1980. Contract AC22-79PC20091. 307p. NTIS, PC A14/MF A01.

From 1. conference on ground control problems in the Illinois coal basin; Carbondale, IL, USA (22 Aug 1979).

The first conference on ground control problems in the Illinois Coal Basin was held at the Southern Illinois University at Carbondale, Illinois, August 22-24, 1979. Twenty-one papers from the proceedings have been entered individually into EDB; one had been entered previously from other sources. (LTN)

13339 (CONF-790894—, pp 268-282) **Effect of geotechnical factors on the subsidence response.** Edl, J.N. Jr. (Dept. of Energy, Carbondale, IL). Jun 1980.

From 1. conference on ground control problems in the Illinois coal basin; Carbondale, IL, USA (22 Aug 1979).

The subsidence response for an excavation mined under an overburden consisting of exclusively coal measure strata is well behaved and is somewhat predictable, providing the geometrical geotechnical factors of seam thickness (m), seam depth (h), and excavation width (w) have been determined. There are, however, several additional geotechnical factors that can affect the subsidence response and these factors should be considered when predicting subsidence and/or characterizing the subsidence response. Accordingly, to assist in interpreting the subsidence response, it is important to conduct some sort of geotechnical investigations to determine whether or not any of the pertinent geotechnical factors are present.

13340 **(DOE/ET/12548—4) Critical parameters for coarse coal underground slurry haulage systems.** Maynard, D.P. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Feb 1981. Contract AI01-76ET12548. 55p. (JPL-PUB—81-11). NTIS, PC A04/MF A01.

This report describes the basic parameters which directly influence the behavior of a coal slurry pipeline transportation system and determine the limitations of the system performance. The purpose of this technology assessment is to provide an identification and understanding of the critical factors which must be given consideration in the design and evaluation of such a slurry haulage system intended for use in an underground coal mine. The slurry haulage system will be utilized to satisfy the transportation requirements of conveying, in a pipeline, the coal mined by a continuous mining machine to a storage location near the mine entrance or to a coal preparation plant located on the surface. Coal-water slurries, particularly those consisting of homogeneous suspensions of small particles, frequently behave as non-Newtonian, Bingham-plastic fluids. For successful operation, slurry transport systems should be designed to operate in the turbulent flow regime and at a flow rate at least 30% greater than the deposition velocity. The deposition velocity is defined as the slurry flow rate at which the solid particles tend to settle in the pipe. Due to the importance of accurately determining the deposition velocity and the uncertainties of current methods for predicting the deposition velocity of coarse particle slurries, it is recommended that experimental efforts be performed as a part of the system design. The capacity of the haulage system should be compatible with the mine's projected coal output in order to avoid operational delays and the necessity for in-mine coal storage. The slurry pumps must generate sufficient discharge pressure to overcome the resultant friction losses in horizontal and vertical pipe sections and to satisfy the slurry hoisting requirements.

13341 **(FE—1231-19) Design optimization in underground coal systems. Volume I. The CONTUR program. Final technical report as of February 28, 1981.** (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering). 28 Feb 1981. Contract AC01-76ET10722. 65p. NTIS, PC A04/MF A01.

The objective of the research effort was to upgrade the previously developed CONTUR computer program to ensure that it would be able to accommodate a variety of possible surface conditions, be able to complete the analysis, and to revise and upgrade the user manual. The objectives of the research effort were accomplished, and the CONTUR program is now capable of contouring all surfaces including the very flat surfaces that previously resulted in some difficulty with the initial version of this program. The user guide was also rewritten and in test cases has proved to be an effective document for the program user. Potential application of the research as a result of the revision of the CONTUR program should find greater application in developing and establishing the centerline projections of most types of mineral deposits with particular reference to coal seams. The primary goal of the program is to grid irregularly spaced borehole data and has been accomplished very successfully. Other than the conventional contouring technique, polynominal surfaces may be fitted to either the gridded or ungridded data, however, the plotting is optional. The output from CONTUR may be used for its own value and also as input data supplying gridded data to the RESERV-COAL computer program.

13342 **(FE—1231-23) Design optimization in underground coal systems. Volume V. An optimal determination of longwall panel dimensions. Final technical report as of February 28, 1981.** (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering). 28 Feb 1981. Contract AC01-76ET10722. 71p. NTIS, PC A04/MF A01.

Longwall mining of coal offers the potential of improved productivity and safety, better ground control, higher levels of mechanization and recovery, and lower unit production cost. The production capacity of a longwall panel is influenced by several variables: the rate of face advance, the thickness of extraction, the operating speeds of cutting and tansporting equipment, the width and length of panels, physical and chemical characteristics of coal seams, and the geologic, tectonic and rock mechanic properties of the mine environment. The effect of the width and length of a longwall panel on its production capacity was investigated and a methodology for optimizing these dimensions was developed. The results indicated that the width of longwall panels are sensitive to the objective criteria of the decision maker. The optimum panel widths, investigated under four different objectives: the minimum average unit cost, the maximum internal rate of return, the maximum profitability index, and the minimum present value of unit production cost, were varied within the range of 270 to 720 feet. The minimum average unit cost objective resulted in optimum panel widths in the range of 450 to 550 feet, which corresponds to present practice. The optimal values of the widths obtained under the four different objectives are monotonically increased as the panel length increases. The optimum width may vary within considerable limits depending upon the objectives of the longwall face design. The widths are also sensitive to changes in investment in the panel, life of the equipment and the cycle time. Longer panel lengths may be desirable, but should be limited by operational constraints. The model may prove invaluable when evaluating the development of new longwall panels.

13343 **(FE—1231-26) Design optimization in underground coal systems. Volume VIII. The roof truss: an analysis with applications to mine design. Final technical report.** (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 28 Feb 1981. Contract AC01-76ET10722. 356p. NTIS, PC A16/MF A01.

The purpose of this research effort was to optimize the application of the roof truss for use in supporting coal mine roofs. Model analysis using two-dimensinal, body-loaded, photoelastic models was supplemented with field data and testing. A detailed literature review was also undertaken. The detailed analysis of photoelastic models of roof trusses was pursued by varying a number of the truss parameters - center-span installation angles and blocking-point configuration. In obtaining reduced deflection, the best support was achieved employing an angle of installation of 90°. However, due to roof failute considerations, the recommended angle of installation was 45°. Blocking points were shown to have an effect on roof-support capacity as well as truss span, and field tests indicated that the installation of a roof truss actually raised the roof. Also, from field measurements, it was shown that all sections

of the arch carried the same load. The use of the roof truss as a major support principle and device in underground coal mines was confined. The installation angle should be 45° in any specified roof span. Blocking is an essential part of the arch installation and should be carefully implemented to insure maximum efficiency of the arch. It was concluded that: the truss installation of 45° produces maximum benefit when the overall stability of the roof is considered; the two-dimensional, body-loaded photoelastic model may be used to analyze underground structures; in underground installations, all components of the roof truss structure sustain the same load; and uplift of the roof may be achieved during installation of the roof truss system.

13344 **(FE—1231-28) Design opimization in underground coal systems. Volume X. Underground longwall ground control simulator (LONGWALGRCON-SIM). Final technical report.** (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). 28 Feb 1981. Contract AC01-76ET10722. 258p. NTIS, PC A12/MF A01.

A detailed literature review was conducted with particular reference to the ground-control mechanisms of longwall mining systems in the United States. In addition a longwall simulator program was constructed to facilitate equipment selection and design on the longwall face and the support requirements that might be needed in the head and tail entries. The mechanics of ground behavior around the longwall face and the head and tail entries were analyzed and formed the basis for the computer program. The computer simulator LONGWALGRCON-SIM to represent face behavior and specify face equipment capacities was completed. Roof classification for the head and tail entries can be included in the simulator output if optioned. A user manual for the program was produced, including typical program input and output together with the logic used in the program. The major application of the research lies in the application of the computer program to facilitiate design of new longwall operations. Significant conclusions are as follows: insufficient information exists for US longwall mining operations to derive totally reliable ground-control relationships; the longwall simulator does establish the practicality of computer-assisted design of longwall operations; the data requirements of LONGWALGRCON-SIM provide a framework for the collection of ground-control data necessary for face-and-entry design; and face-support requirements can be specified using the computer-assisted, longwall-face simulator.

13345 **(PB—80-179187) A program plan for determining optimum roof bolt tension. Theory and application of rock reinforcement systems in coal mines. Volume 2. General bibliography. Open file report (final), October 1977-March 1979.** Lang, T.A.; Bischoff, J.A.; Wagner, P.L. (Leeds, Hill and Jewett, Inc., San Francisco, CA (USA)). Mar 1979. 43p. NTIS, PC A03/MF A01.

The objective of this investigation was to develop a program plan of analytical studies and tests to determine (1) the optimum installation tension of a coal mine roof bolt, (2) the most valid bolt support theory or theories, and (3) the most valid roof failure theory or theories. Volume 2 contains the bibliography.

13346 **(PB—80-179195) A program plan for determining optimum roof bolt tension. Theory and application of rock reinforcement systems in coal mines. Volume 1. Open file report (final), October 1977-March 1979.** Lang, T.A.; Bischoff, J.A.; Wagner, P.L. (Leeds, Hill and Jewett, Inc., San Francisco, CA (USA)). Mar 1979. 255p. NTIS, PC A12/MF A01.

The objective of this investigation was to develop a program plan of analtyical studies and tests to determine (1) the optimum installation tension of a coal mine roof bolt, (2) the most valid bolt support theory or theories, and (3) the most valid roof failure theory or theories. On this basis, a comprehensive literature search was made and significant material dealing with coal mine roof behavior, roof bolting, and roof support was collected, reviewed, classified, and analyzed. Emphasis was given to the influence of rock reinforcement on the control of deformation, stress field modification, and mine roof stability. An assessment was made of the effect of various parameters including bolt tension, bolt pattern, and time of installation on the effectiveness of rock reinforcement systems, and equations were developed for bolt tension as a function of these parameters and rock properties. From these studies, a major program plan of tests and studies was developed to verify and validate the most tenable theories of roof behavior and roof support and to determine optimum bolt installation tension.

13347 **(PB—80-181217) Long-term response of a coal mine roof to time lapse between exposure and support. Technical progress report 1976-79.** Radcliffe, D.E.; Stateham, R.M. (Bureau of Mines, Denver, CO (USA). Denver Research Center). 1980. 17p. NTIS, PC A02/MF A01.

The Bureau of Mines, as part of an agreement with the Bear Coal Co., Somerset, Colo., evaluated the response of a coal mine roof to time lapse. Time lapse, the interval between exposure and support of the roof, was studied using both instrumentation and statistics. Instrumentation studies were designed to equate displacement and rates of displacement with areas of roof left unsupported from 15 minutes to more than 4 days. A statistical study was completed to compare roof fall occurrence with time lapse intervals encountered during normal room-and-pillar mining. Results from this investigation show time lapse, in the Bear mine, to be insignificant with respect to roof stability after installation of permanent support.

13348 **(PB—80-191513) Energy and environmental research for minerals and enterprise development.** (Tri-County Council for Western Maryland, Inc., Cumberland (USA)). Jun 1979. Contract ARC-77-122/MD-5632. 175p. NTIS, PC A08/MF A01.

The main objective of this project was to provide an analysis of the economic impacts to Allegany and Garrett Counties in Maryland of increasing levels of coal mining. Secondary objectives were to provide a cost/benefit evaluation of the existing Maryland surface mine reclamation program; an evaluation of coal-related enterprise development potentials for Western Maryland, including utilization or conversion industries, educational and training programs, research programs; and an evaluation of the existing tax structure affecting the Western Maryland coal industry. Each of these areas of study in the final report is followed by recommendations directing Western Maryland toward a balanced and rational approach to development of its coal resources.

13349 **Session papers presented at the 1980 American Mining Congress international coal show.** Washington, DC; American Mining Congress (1980). 795p. (CONF-8005142—).

From American Mining Congress international coal show; Chicago, IL, USA (5 May 1980).

The American Mining Congress International Coal Show was held at McCormick Place, Chicago, IL, on May 5-8, 1980. Sessions were held on US energy policy, longwall mining, coal preparation, surface mining operations and regulations, communications (public relations), coal transport, mine management (productivity), safety and health, synthetic fuels, underground face operations, fugitive dust, underground service operation (communications, maintenance, methane control), and political action. Sixty-one papers have been entered individually into EDB and three also into Energy Abstracts for Policy Analysis. (LTN)

0130 Transport And Handling

13350 **(DOE/PC/30076—T2) Project to develop and demonstrate methods to eliminate frozen coal handling problems. Status report II.** (United Coal Co., Bristol, VA (USA)). 23 Jan 1981. Contract AC22-80PC30076. 17p. NTIS, PC A02/MF A01.

Extensive tests, utilizing the miniature rail hopper car, miniature shakeout facility and the freezer unit, were completed on some eight different major suppliers' freeze conditioning agents (FCA's), all of which are manufactured for the purpose of inhibiting the shear strength of frozen coal. Generally, the tests proved that these chemicals offer some relief to the problem up to a point. However, in sub-zero temperatures from -10°F and beyond, none of the FCA's tested proved very effective. In each instance on each different FCA application, two pints per ton of the chemical were sprayed onto the coal as it was loaded into the miniature hopper

car. Average cost of the FCA's is one dollar per pint, indicating the average charge to treat 100 tons of coal amounts of $200.

13351 **Pilot plant for oil-water emulsion cleaning of pulverized coal. Final report, February 1, 1980-January 31, 1981.** Purcell, G. Sante Fe, NM; New Mexico Energy Research and Development Program (1981). 30p. (NP—25270).

The process of cleaning fine coal by spherical agglomeration, for which many patents have been granted, has not yet been applied on a commercial scale, despite encouraging experimental evidence of its capabilities. Other factors such as the economic feasibility and environmental compatibility of the process must be taken into consideration before it can be shown to be competitive. The purpose of this study was to apply emulsion technology (frequently referred to as spherical or oil agglomeration) to some New Mexico steam coals. The following conclusions were reached: (1) The oil agglomeration process is technically able to clean different New Mexico coals of very fine particle sizes. Combustible recoveries of around 90% and moisture contents well under 20% can be obtained under the proper conditions. Even coal containing extremely high amounts of ash material (+50%) can be successfully cleaned with appreciable improvements in calorific value. (2) Oil addition is the most important variable. Increasing oil addition increases recovery and agglomerate diameter and reduces ash content, retained moisture and inversion time. Approximately 20% total oil addition seems to strike a balance between low ash content, low moisture content, and high combustible recovery on the one hand and oil consumption on the other. (3) Analyses indicate that the process tends to concentrate sodium and organic sulfur in the clean product. (4) The addition of surface-active agents does not reduce oil consumption or moisture content. (5) Pilot-plant results tended to be an improvement on bench-scale tests. (6) A multistage process seems to be more effective than a single-stage process in realizing the full potential of oil agglomeration for cleaning coal. (7) The clean pellets produced are large enough for easy handling with minimal dusting and will air-dry to a moisture content essentially the same as the raw coal.

13352 **(ORNL/TM—7337) Laboratory and field analysis of factors affecting quality of leachate from coal storage piles.** Davis, E.C.; Boegly, W.J. Jr.; Tamura, T. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 208p. NTIS, PC A10/MF A01.

Thesis. Submitted by E.C. Davis to Vanderbilt Univ., Nashville, TN.

It is the purpose of this research to investigate the potential environmental problems associated with the runnoff from coal storage facilities and to suggest methods of circumventing the acidic leachate. Specifically, controlled laboratory and field-scale experiments have been carried out which identify and investigate various factors believed to be influential in determining leachate quality. These factors, including coal type (high or low sulfur content), exposed coal surface area, storage moisture conditions, rainfall intensity, frequency, and duration have all been suggested as being important in determining leachate quality and are discussed in detail. An examination of reported data from Illinois Number 6 and Montana Rosebud coals indicates that a direct comparison of leachate from laboratory-scale column leaching experiments does not adequately predict the quality of leachate which occurs from larger volumes of the same type of coal stored under natural field conditions. Comparisons of leachate quality between laboratory and field-scale experiments could only be made after the data had been normalized, based on the weight of coal in storage and the ratio of rainfall volume to unit coal surface area. It is recommended, therefore, that in laboratory experiments designed to simulate the leachate from actual coal storage piles, the rainfall volume per unit time be identical to expected field conditions and the exposed coal surface area be adjusted so that the ratio of rainfall volume to unit area of coal surface be similar to that occurring in the actual coal pile.

13353 **(PB—80-193667) Coal haul roads study. Final report Jul 78-Feb 80.** Covil, J.L.; Ingold, D.P. (Smith (Wilbur) and Associates, Columbia, SC (USA)). Apr 1980. Contract DOT-FH-11-9451. 124p. NTIS, PC A06/MF A01.

The purpose of this report is to provide an estimate of the extent of improvements needed on the Nation's coal haul roads. Roads used for coal hauling are first identified and classified according to volume and duration of coal traffic, Federal-aid designation, and functional classification. Road mileage in each of these categories is shown in Chapter II. Chapter III shows existing and forecast deficiencies on each part of the coal road system and provides estimates of the cost of improving each component of the system to full improvement standards. Chapter IV introduces a reduced cost alternative where roads in need of repair are resurfaced or reconstructed on existing alignments.

13354 **(PNL-SA—8245) Sliding-bed model applied to noncircular pipe hydrotransport.** Eyler, L.L.; Lombardo, N.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1980. Contract AC06-76RL01830. 20p. (CONF-800804—37). NTIS, PC A02/MF A01.

From ASME century 2 emerging technology conference; San Francisco, CA, USA (10 Aug 1980).

A model based on a force balance analysis for sliding-bed hydrotransport in noncircular pipes is presented. Predictions of the model are compared with previously published hydrotransport data for 1.379-mm glass beads (S = 2.93). The beads were transported in rectangular pipes with aspect ratios of 0.5, 1.0, and 2.0, as well as in a 25.4-mm circular pipe. Delivered volumetric concentration ranged from 0.018 to 0.155. For equal delivered concentrations in equivalently sized pipes, the data showed that the rectangular pipe with the wide side on the bottom required less pump head than a circular pipe at a given apparent mean velocity. The developed model correctly predicts this data trend. These results demonstrate the extended versatility of the force balance approach for modeling hydrotransport phenomena.

13355 **(RI-PMTC—10(80)) Technical performance comparison of coal-pyrite flotation and high-gradient magnetic separation.** Hucko, R.E.; Miller, K.J. (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Mining Technology Center). Nov 1980. 60p. NTIS, PC A04/MF A01.

The Coal Preparation Division of the Pittsburgh Mining Technology Center conducted an investigation to assess and compare the pyritic sulfur reduction potential of coal-pyrite flotation and high-gradient magnetic separation (HGMS). Tests were run on three coals - an Upper Freeport bed coal, a Lower Kittanning bed coal, and a Pittsburgh bed coal - to establish grade-recovery relationships characteristic of both processes. Representative portions of each coal sample were crushed to two top sizes - nominal minus 35 mesh and nominal minus 100 mesh - and subjected to conventional froth flotation. The froth product was then beneficiated by coal-pyrite flotation or HGMS to provide a direct technical comparison of the two processes. In addition, the raw coal samples were float-sink tested, and HGMS tests were run directly on the raw coal to assess the technological merit of single-stage HGMS. At minus 35 mesh, the size normally employed for coal flotation, both coal-pyrite flotation and HGMS effectively separated pyrite from coal, and the performance of the two processes was essentially the same. At a size of minus 100 mesh, however, the performance of HGMS exceeded that of coal-pyrite flotation. The separation effected by HGMS were more efficient at minus 100 mesh than at minus 35 mesh. On the other hand, it was concluded that either the effectiveness of coal-pyrite flotation decreases with diminishing top size, or the process has not been optimized to treat material finer than 35 mesh. Morever, as demonstrated by float-sink analyses, the separations achieved by all processing schemes considered were far from optimal.

13356 **Upgrading of lignite to enhance fuel value.** Baker, A.F.; McKeever, R.E.; Deurbrouck, A.W. (Dept. of Energy, Pittsburgh, PA). pp 28p, Set No. 4, Paper 2 of Session papers presented at the 1980 American Mining Congress international coal show. Washington, DC; American Mining Congress (1980).

From American Mining Congress international coal show; Chicago, IL, USA (5 May 1980).

Laboratory research and development studies show that lignite pellets can be produced with low moisture content and with a binder that will provide good mechanical strength and resistance to moisture pick-up, to spontaneous ignition, and to dusting during handling. The effects of binder composition, binder level, lignite particle size and extent of drying on the ability to produce satisfac-

tory lignite pellets were studied. Lignite pellets made with 5 percent or more asphalt emulsion binder were found to be the most resistant to degradation, water pick-up and spontaneous heating. A pilot-scale test was successfully carried out to coordinate the unit operations of grinding, mixing, pelletizing, and pellet drying into a continuous process for the production of 50 tons of lignite pellets. Based on these results, a conceptual design and cost analysis was prepared for a facility to produce 4,000 tons per day of lignite pellets. The total cost of production was estimated to be about $18.00 per ton of pellets. Bench scale tests show that excellent sodium reduction in lignite can be achieved by exchanging the sodium with hydrogen ions from aqueous sulfuric acid. A description of a conceptual design of a 1.58 x 10^6 tons per year facility to reduce the sodium content from 8.5 to 4 percent (based on Na_2O in ash) is presented. The fixed capital investment was estimated to be 6.9 million dollars and the annualized total cost was determined to be 2.06 million dollars, which translates to $1.30 per ton of lignite processed.

0140 Combustion

REFER ALSO TO CITATION(S) 13314, 13332, 14219, 14516, 14570, 14878

13357 **(DOE/ET/10744—T1) Investigation of the devolatilization of coal under combustion conditions. Seventh quarterly report, 1 April-30 June, 1980.** Seery, D.J. (United Technologies Research Center, East Hartford, CT (USA)). Apr 1980. Contract AC01-78ET10744. 19p. NTIS, PC A02/MF A01.

This report describes progress during the seventh quarter of a two year contract to study pyrolysis of coal under combustion conditions. Major accomplishments of this quarter have been the infrared analysis of two new coals, heated grid devolatilization of these coals over the entire available temperature range, quantitative measurements of tar and char nitrogen contents, measurements of NO formation during early phase of combustion of coal, high speed photography of tar release from a Pittsburgh bituminous coal, relating the early tar release of the bituminous coal to its voltatiles combustion behavior.

13358 **(DOE/PC/30290—T1) Preignition volatile yield as related to coal characteristics. Quarterly report, October-December 1980.** (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Jan 1981. Contract AC22-80PC30290. 9p. NTIS, PC A02/MF A01.

The computer model for the study of pulverized fuel processing is being modified to reflect the effect of variations in preignition volatile yields on the burning of coal in a conventional swirl burner. Two important criteria which define the performance of suspension burning of a solid fuel in a swirl burner are: (1) flame stability; and (2) combustion efficiency. Both of these parameters depend strongly on the ratio of kinetic or combustion time scales of the fuel to the residence time available in the vicinity of the recirculation zone of the swirl burner. Enhanced pyrolysis yield at high heating rate may function in three ways in boiler combustion: (1) enhanced mixture ignitability, resulting in a heat release closer to the input structure; (2) enhanced combustion rate, allowing easier overall stabilization of the flame; and (3) ehanced fuel burnout both in the vicinity of the recirculation stabilization region and downstream of it. The existing combustion model, previously developed at AERL, Inc., for general modeling of pulverized fuel processing, is being modified to investigate these effects in a semi-quantitative manner. The flow, mixing and radiative environment of a swirl are simulated, while the combustion history of the fuel is predicted as a function of such fuel-related parameters as size distribution, volatile yield and char reactivity. Ten different coals have been selected and the test reactor has been modified to improve operability and the precision of the results. (LTN)

13359 **(DOE/PC/30293—1) Effects of preignition on pulverized coal combustion. First quarterly report, September 19-December 31, 1980.** Simons, G.A.; Kothandaraman, G. (Physical Sciences, Inc., Woburn, MA (USA)). Jan 1981. Contract AC22-80PC30293. 32p. NTIS, PC A03/MF A01.

The theoretical task of optimizing pore structure with respect to char reactivity has indicated that the total porosity and the distribution of porosity are the most important char characteristics to consider when trying to optimize char oxidation above 800°K. The bench scale experiment designed to achieve the optimum char structure has been designed and will be constructed during the next quarter.

13360 **(DOE/PC/30306—T1) Basic combustion and pollutant-formation processes for pulverized fuels. Quarterly technical progress report No. 1, 1 October 1980-31 December 1980.** Germane, G.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 15 Jan 1981. Contract FG22-80PC30306. 30p. NTIS, PC A03/MF A01.

A study of basic combustion and pollutant formation processes for pulverized solid fossil fuels has been initiated. The solid fossil fuels under consideration for this research include such solid fuels as non-bituminous coal types, solvent refined coal, combustion char, petroleum coke, oil shale and tar sand. The potential industrial application of pulverized fuels other than coal provides some promise for relief from present and future conventional fuel shortages. Utilization problems with these fuels such as flame stability, fuel handling, pollutant emission and ash and slag formation in large-scale furnaces may be fundamentally addressed in laboratory reactors using properly scaled operating variables. An extensive literature search was begun to assess current knowledge relative to utilization of these fuels. This review will provide a basis for selection of three solid fuels for testing. Pertinent information from industrial contacts will also be used in the fuel selection. The criteria to be used in the selection of these fuels include availability for economic industrial use, adaptability, grindability, flame stability, entrainability, uniformity, applicability to direct firing with air, solidity with heating, availability to the BYU Combustion Laboratory, cost, other physical characteristics affecting their use, industrial input and recommendations, and DOE approval. The existing laboratory coal combustor at BYU will be modified to provide flexibility for a potentially wide range of operating characteristics with the selected solid fuels. A computer system has been identified for interface both to the reactor for data acquisition and control of operating variables and to the main research computer for final data reduction and display.

13361 **(FE—2683-T1(Pt.1)) Catalytically supported thermal combustion of coal-derived low-Btu gas. Part I. Performance with low-Btu gas fuels. Final report.** Osgerby, I.T. (Engelhard Minerals and Chemicals Corp., Edison, NJ (USA). Engelhard Industries Div.). 1979. Contract EF-77-C-01-2683. 310p. NTIS, PC A14/MF A01.

A laboratory scale experimental program was conducted to determine design criteria for specification of catalyst configurations for catalytically supported thermal combustion of low Btu gas. The range of experimental parameters was chosen to simulate gas turbine combustion operation. Flashback-free operation was demonstrated for premixed combustor feed to a CATCOM catalyst over the entire range of an anticipated commercial cycle. The effect of inlet gas compositional variables on combustion efficiency was defined. The trade off between combustion efficiency and pressure loss was evaluated by testing five catalyst configurations having different catalyst volumes and geometric properties. A prototype catalyst configuration was selected, and a parametric performance map was developed showing the effect of low Btu gas composition, heating value, operating temperature and pressure, and reference velocity. No effect of low Btu gas heating value on combustion efficiency was observed over the range 4.5 to 6.75 Mg/m^3 (120-180 Btu/ft^3). A lower inlet temperature which ensures combustion efficiency > 99 percent at 30.5 m/s was 200°C. An inlet temperature of 150° was sufficient to maintain combustion efficiency > 99 percent at 15 m/s. Pressure loss for the preferred configuration was as low as 3.6%, even at 30.5 m/s reference velocity.

13362 **(PB—80-178452) Quality assurance of fluidized-bed combustion (FBC) H_2SO_4 measurements. Final report, May 1977-August 1978.** Acciani, T.R.; Maddalone, R.F. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). Jul 1979. 35p. NTIS, PC A03/MF A01.

The report gives results of a study to: evaluate existing data on H2SO4 measurements from fluidized-bed combustion (FBC) processes; determine the true value of the H2SO4 concentration

which might have been obtained had the control condensation (Goksoyr/Ross) procedure been used; and run a material compatibility study to find alloys that can be used to fabricate a controlled condensation sampling system. The sampling system at Exxon's FBC facility was reviewed: H2SO4 values are about 12% low with another reduction of 10-25% because of low sampling temperatures and Balstron filters. The control condensation system with an acid/base titration using bromophenol blue as the indicator is the recommended sampling/analysis method for H2SO4 sampling at the Exxon facility. Construction material for the controlled condensation system can be 316L stainless steel, which had the best performance when subjected to various tests used to simulate an FBC environment and will easily withstand the pressures found at the Exxon facility.

13363 **Low Btu coal gas combustion in high temperature turbines.** Vogt, R.L. (GE, Schenectady, NY). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-170, 1-9(1980).

This paper defines the combustion consequences of burning low Btu coal gas in high temperature gas turbines. It identifies the limits of their application regarding the heating value and its thermodynamic constraints on turbine firing temperature, operating flammability limits, product carbon monoxide, oxides of nitrogen and combustor turndown ratio. Sensitivity to reaction zone radiation and effects on combustor hot gas path flow area are discussed. 4 refs.

13364 **(FE—2683-T1(Pt.2)) Catalytically supported thermal combustion of coal-derived low-Btu gas. Part II. Performance with medium-Btu gas fuels. Final report.** Osgerby, I.T.; Lee, H.C. (Engelhard Minerals and Chemicals Corp., Edison, NJ (USA). Engelhard Industries Div.). [nd]. Contract EF-77-C-01-2683. 138p. NTIS, PC A07/MF A01.

The feasibility of catalytically-supported thermal combustion (CATATHERMAL) of stimulated medium Btu coal gas fuel has been demonstrated in laboratory test results. The experimental results indicate that medium Btu fuel having a lower heating value in the range of 7.5 to 12.0 MF/m^3 can be combusted with a high combustion efficiency (99.8 percent) at an acceptable pressure loss (4.2 percent) and with essentially no NO/sub x/ emissions at conditions which simulate an industrial gas turbine application. Design performance maps were generated from which a prototype combustor may be designed. Simple correlations were developed to allow extrapolation to operating conditions outside of the range evaluated. Test results were consistent with the performance tests obtained using low Btu gas fuels; however, effects of operational variables on the catalyst performance were more noticeable. This was shown to be attributable to the wider range of percent carbon monoxide and hydrogen in the two simulated medium Btu coal gas test fuels. In addition, the most sensitive fuel parameter for combustor performance appears to be the ratio of H_2/CO in the fuel, regardless of heating value.

0150 Marketing And Economics

13365 **(PB—80-184518) The direct use of coal. Volume II-part A: working papers. Appendices I thru VI.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Nov 1979. 560p. NTIS, PC A24/MF A01.

The contents include: (1) Selection topics in estimating future energy demand and supply, (2) rethinking the scale of coal-fired electric generation: technological and institutional considerations, (3) Residential and commercial uses of coal, (4) Coal cleaning and desulfurization, (5) Direct utilization of coal: flue gas desulfurization, and (6) Miners and operators collective bargaining in coal.

13366 **(PB—80-184542) The direct use of coal. Volume II-part D: working papers. Appendices XV thru XVII.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Dec 1979. 425p. NTIS, PC A18/MF A01.

The contents include: (1) Federal coal leasing policy: a status report; (2) Law applicable to air emissions from direct use of coal; (3) Surface Mining Control and Reclamation Act of 1977.

13367 **(SAND—80-7163) Economic analysis of advanced technology bits and picks for a longwall mining system.** Felts, L.L.; Gabello, D.P.; Hayoz, F.P. (TRW Energy Systems Planning Div., McLean, VA (USA)). Jan 1981. Contract AC04-76DP00789. 126p. NTIS, PC A07/MF A01.

The introduction of advanced technology longwall shearer bits, continuous miner picks and roof bolter bits into contemporary longwall mines was analyzed to determine the effect on machine productivity, capital investment and operating and maintenance costs. Parametric combinations of advanced technology component life and cost were generated, since both factors are still to be determined, and a discounted cash flow analysis was conducted to establish a coal production cost. Breakeven and optimal lives and costs for the advanced technology components were found through comparison of coal production costs to that of the baseline cost of coal production. Under reasonable parameter levels of component lives and costs, a 3.5% reduction in coal production cost can be achieved.

0160 Health And Safety

REFER ALSO TO CITATION(S) 13330, 13349, 14664

13368 **(PB—80-176597) Regulation of the coal industry-health and safety, surface mining and other issues. Parts I and II.** Gordon, R.L.; Manula, C.B.; Ramani, R.V. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Economics). 1979. 703p. NTIS, PC A99/MF A01.

Efforts to appraise impacts of the Coal Mine Health and Safety Act (CMHSA) of 1949 and surface mining regulations are reviewed. Also, an overview of numerous policies restricting the production and use of coal is presented. The effects of CMHSA on output were appraised by three methods, all of which indicate that CMHSA has reduced productivity significantly and concurrently raised coal mining costs 20 to 30 percent. Regression analyses demonstrate that costs appear to be five to twenty times higher than safety benefits. Data on potential health benefits suggest that they are unlikely to be great enough to raise benefits to equal costs. Hence, CMHSA advocates must show that benefit estimates are seriously understated. Analysis of surface mining regulations demonstrates that unless estimates of aesthetic benefits are grossly underestimated, surface mining reclamation entails costs which far exceed benefits. Global implications of these studies are not easily determined. A simulation study discusses health and safety regulations. A case study of a western strip mine provides extensive data which may or may not be representative. Overall, the conclusion is that the cost effectiveness of surface mining regulations is questionable.

13369 **(PB—80-192651) Emergency medical needs of coal mines. Final report.** Pickar, E.R. (Orkand Corp., Silver Spring, MD (USA)). Jul 1977. Contract PHS-NIOSH-210-76-0180. 159p. NTIS, PC A08/MF A01.

State and Federal regulations were reviewed, underground coal mines were visited, meetings with medical and safety experts were conducted, and accident and injury statistics for 1972 to 1975 were analyzed to identify the emergency medical resources required in underground coal mines. Recommendations were made concerning which first aid supplies should be kept, how and where they should be stored, and how often they should be inspected. Personnel staffing and training procedures were discussed, including the design of a basic first aid course for the miners. Procedures were developed for integrating emergency medical services with existing medical resources. Guidelines were included for communications between mine operators and health care, provide transportation of injured miners, memoranda on higher level medical care, disaster linkages, and program evaluation. Excerpts from the code of federal regulations, lists of surveyed states and panel participants, coal accident and injury data, grants for emergency medical services in 1977, ambulance design criteria, and specifications for essential ambulance equipment are provided.

13370 **(PB—80-199912) Control technology for worker exposure to coke oven emissions. Technical report.** Sheehy, J.W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). Mar 1980. 37p. NTIS, PC A03/MF A01.

Numerous studies have shown 'coal tar' products increase the risk of skin and lung cancer. One study showed top side coke oven workers had a lung mortality rate of 10 times that of all steel workers. Another study showed that men employed at coke ovens for more than five years showed a mortality rate 3.5 times the expected rate. In view of this significant health hazard to thousands of coke oven workers a NIOSH in-house study to assess coke oven control technology was performed. Control technology for coke ovens was assessed through visits to seven United States coke oven plants with state-of-the-art control technology and by a review of current coke oven control technology literature. Each control method is briefly described and the effectiveness of import engineering and work practice controls is presented. The report discusses, separately, controls for charging emissions, pushing emissions, door emissions, and top side leaks.

0170 Legislation And Regulations

13371 **Permitting: problems, solutions, recommendations.** Lyons, W.W. (NERCO Inc., Portland, OR). pp 11p, Set No. 3, Paper 8 of Session papers presented at the 1980 American Mining Congress international coal show. Washington, DC; American Mining Congress (1980).

From American Mining Congress international coal show; Chicago, IL, USA (5 May 1980).

In theory, permitting is an effort to eliminate uncertainty in surface mining and develop a strategy for mine planning and development that both the coal operator and the regulatory authority will agree upon in advance. Basically, there are three major parts to a surface mining permit which structure the permitting process. First, an environmental inventory of the conditions at the proposed minesite before mining begins; second, a detailed plan of how the operator expects to disrupt these conditions during surface mining; and third, the conditions to which the mine will be restored at the conclusion of mining. An approved surface mining permit is a contract between the operator and the state regulatory authority, as trustee for the public. The operator agrees to pay for both the short and the long-term effects of surface mining; and the public allows the operator to proceed despite some uncertainty regarding potential long-term environmental impacts of surface mining. Because permitting often creates real or potential interagency conflicts between OSM and state regulators, permitting also requires skillful negotiation, diplomacy and compromise.

02 PETROLEUM

REFER ALSO TO CITATION(S) 14198

13372 **(DOE/BETC/QPR—80/3) Liquid Fossil Fuel Technology. Quarterly technical progress report, July-September 1980.** Linville, B. (ed.). (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Feb 1981. 67p. NTIS, PC A04/MF A01.

Research activities at BETC are summarized under the headings liquid fossil fuel cycle, extraction (resource assessment, production, enhanced recovery), processing (of liquids such as coal liquids, and crudes, thermodynamics), utilization (energy conversion, combustion), and project integration and technology transfer. (DLC)

0202 Geology And Exploration

13373 **(SAND—80-2424C) Self and transfer impedances of coaxial coils for interrogating a borehole formation.** Yu, J.S. (Sandia National Labs., Albuquerque, NM (USA)). 1980. Contract AC04-76DP00789. 16p. (CONF-801181—1). NTIS, PC A02/MF A01.

From 50. annual international meeting of the Society of Exploration Geophysicists; Houston, TX, USA (16 Nov 1980).

The driving-port and receiving-port impedances of conducting coils vary with the electromagnetic (EM) properties surrounding matter. The need to reduce the ambiguity in formation evaluations for tight or shaly sands has motivated borehole interrogations using multiple frequencies. Frequencies from 10 to 100 MHz seem an optimal range for operating coaxial coils. The coils' impedances below 10 MHz become less sensitive to the dielectric properties of formation, and higher-order-mode couplings above 100 MHz become too complex to invert measurable impedances. Only the dipole and quadrupole couplings are retained for typical coil diameters (5 to 20 cm) to reduce coil-design and data-inversion inaccuracies. Calibration requirements consistent with theoretical assumptions provide means of validating the operation ranges of actually designed coils. Equivalent circuits between coaxial-coil ports are formulated to visualize the coupling mechanisms involved. Various measurements on the self and transfer impedances enable the self-consistency checks on whether an interrogated formation is indeed homogeneous and isotropic. The impedance measurements also provide a data base for parameter-optimization techniques to quantify the often-heterogeneous/anisotropic formations along a borehole.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 13384, 13659, 13660, 13661, 13666, 14514, 14577

13374 **(DOE/BC/10079—18) Determination of optimum air (gas) injection rate in aerated drilling operations. Annual report, May 1, 1979-April 30, 1980.** Ikoku, C.U. (Tulsa Univ., OK (USA)). Jan 1981. Contract AC19-79BC10079. 52p. NTIS, PC A04/MF A01.

Air, mist, foam, and other variations of aerated fluid drilling are utilized in various areas because of the improved penetration rate when compared to conventional mud drilling. The high compressibility of aerated drilling fluids and multiphase flow phenomena encountered when using these fluids have given rise to sophisticated engineering approach to achieve proper downhole cleaning and material transport. There have been several attempts to calculate the minimum volumetric requirements for air and gas drilling. The results of these studies are valid over limited ranges of drilling rates at best. The method described in this paper will permit the driller and drilling engineer to determine optimum fluid injection rates in the field. It eliminates the need for complicated flow calculations used to predict volumetric air requirements.

13375 **(DOE/IA—0010/8) International energy indicators.** Bauer, E.K. (ed.). (USDOE Assistant Secretary for International Affairs, Washington, DC. Office of Market Analysis). Feb 1981. 29p. NTIS, PC A03/MF A01.

Extensive data are compiled for energy on the international scene and for the US. Data are indicated from the date given and into 1980 as far as available. Data are given for the international scene on: world crude oil production, 1975-to date; Iran: crude oil capacity, production, and shut-in, 1974-to date; Saudi Arabia: crude oil capacity, production, and shut-in, 1974-to date; OPEC (Ex-Iran and Saudi Arabia): capacity, production, and shut-in, 1974-to date; oil stocks: Free World, US, Japan, and Europe (landed), 1973-to date; petroleum consumption by industrial countries, 1973-to date; USSR crude oil production, 1974-to date; Free World and US nuclear generation capacity, 1973-to date. Data are supplied specifically for the US on US gross imports of crude oil and products, 1973-to date; landed cost of Saudi crude in current and 1974 dollars; US trade in bituminous coal, 1973-to date; summary of US merchandise trade, 1976-to date; and energy/GNP ratio.

13376 **(PB—80-198302) Ocean margin drilling: a technical memorandum.** (Office of Technology Assessment (U.S. Congress), Washington, DC). May 1980. 125p. NTIS, PC A06/MF A01.

This report was prepared in response to a request from the Chairman and the Ranking Minority Member of the HUD-Independent Agencies Subcommittee of the Senate Appropriations Committee. It provides an evaluation of the Ocean Margin Drilling Program, a major new public-private cooperative research effort in marine geology proposed by the National Science Foundation. The study discusses the scientific merit of the program, possible alternatives to the present program plan, problems associated with technology development, aspects of petroleum company participation in the program, and government management considerations.

13377 **(PB—80-812126) Petroleum recovery: reservoir engineering and recovery methods. March, 1978-March, 1979 (citations from the Engineering Index Data Base). Report for Mar 78-Mar 79.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 207p. NTIS PC N01/MF N01.

Thermal recovery methods and well stimulation using waterflooding, steam injection, gas injection, and fluid injection techniques are discussed in this bibliography covering worldwide research. Topic areas cover fire flooding, caustic water flooding, miscible displacement, microemulsion flooding, polymer flooding, carbon dioxide miscible flooding, control of water mobility using polymers, and heat loss calculations. Reservoir modeling and simulation studies and studies pertaining to well logging, core analysis, and well perforation are included. A few abstracts discuss techniques of determining residual oil saturation, predicting oil recoverability, and monitoring the degree of flooding. (This updated bibliography contains 196 abstracts, all of which are new entries to the previous edition.)

13378 **(SAND—80-2187C) System to evaluate the performance of insulated tubulars in steam injection wells.** Eisenhawer, S.W.; Johnson, D.R.; Vigil, W.J. (Sandia Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 14p. (CONF-810321—2). NTIS, PC A02/MF A01.

From SPE California regional meeting; Bakersfield, CA, USA (25 Mar 1981).

The efficiency of a thermal enhanced oil recovery project with surface steam generation can be significantly increased by using insulated tubing in the injection wells. In order to evaluate the performance of various insulated tubulars it is necessary to obtain detailed temperature measurements and accurate heat loss data under actual in-field conditions. A system to provide this information has been developed and is in operation at the Aberfeldy steam pilot near Lloydminster, Saskatchewan, Canada. Temperature measurements are made using thermocouples inside and on the outer wall of the injection string; on the outside of the casing, and in a set of three 25 mm (1 in.) ID thermowells attached to the casing. In addition, thin film heat flux sensors are bonded directly to the wall of the injection string. A probe system was designed to measure circumferential temperature variations in the thermowells at depths down to 100 m. This makes it possible to obtain detailed axial temperature profiles. Anticipated hot sports on an insulated joint will be detected in this manner. All of the data is recorded on a datalogger and detailed analysis is performed on a computer system. To date a short test has been carried out using bare 60 mm (2-3/8 in.) injection string tubing. This bare string provides data for comparison with insulated strings. High resolution radial temperature profiles were obtained during this test. Variations in heat loss from the string as functions of time and operating conditions have also been successfully monitored. Heat losses from the string during initial start up on the order of 1.0 Kw/m (1050 Btu/hr-ft) were observed with the heat flux sensors. This is in good agreement with the expected heat loss. The heat flux sensors make it possible to both simplify and improve the determination of insulated tubular thermal performance.

13379 **(SAND—80-2612) Corrosion experiences during the deep steam preliminary field test.** Weirick, L.J.; Johnson, D.R. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01.

Rod specimens of 1018 carbon steel, 1095 carbon steel drill rod and 303 Se stainless steel were exposed to steam environments generated at test sites in Sandia's Area III and in the Kern River Field, Bakersfield, California, by prototype steam generators. The test environment was nominally steam, nitrogen and carbon dioxide at 188°C (370°F) and 340 psia. It was found that in mildly basic steam all three materials performed adequately for substantial exposure times (approximately 25 days). An initial effort to introduce SO_2 gas into the generator feedwater (used as a marker gas) caused the steam discharge to become mildly acidic. During this exposure period the corrosion rates for the carbon steel and drill rod became unacceptably high. Rates were particularly high at the junction with the stainless steel specimen holder where galvanic effects (dissimilar metal couples) enhanced corrosion. The 303 Se stainless steel material did not suffer from this coupling in that the 304L stainless steel holder and 303 Se stainless steel specimen have similar electrochemical potentials. The results show that stainless steel does have adequate corrosion resistance in mildly acidic steam atmospheres. When SO_2 in high concentrations was added to the steam (for reservoir interaction determinations), the corrosive attack on all three materials became severe. Even after short exposure times (8 days steam, $<$ 1 day steam plus SO_2), the carbon steels had disappeared and the stainless steel was severely pitted. Chromel-alumel thermocouples with stainless steel sheaths also were severely attacked by this high SO_2 environment.

13380 **(SAND—81-0444C) Enhanced oil recovery by thermal methods.** Stoller, H.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 15p. (CONF-810315—2). NTIS, PC A02/MF A01.

From 8. energy technology conference and exposition; Washington, DC, USA (9 Mar 1981).

A variety of opinions exist on the future of thermal oil recovery processes ranging from a pessimistic view that they are a diminishing factor because the best reservoirs for thermal floods have already been exploited to the optimistic based on the availability of resources, the gaining of experience, the increasing in prices and the development of new technologies. One fact does exist - the US and the world have tremendous resources of heavy oil for which thermal methods may be the only recovery process. The need exists to develop this capability, and if successful, the impact on availability of hydrocarbons will be great.

13381 **Reliability data base for offshore installations.** Alfsen, T.K. (Rogalandsforskning, Stavanger, Norway); Gjerstad, T.; Moss, T.R. *Terotechnica ;* **2**: No. 1, 23-33(Jan 1981).

This paper presents interim conclusions arising from a preliminary data bank study carried out on behalf of the Norwegian Petroleum Directorate (NPD). The project arose from a request to evaluate the scope for utilising reliability data to improve safety performance offshore. During the course of the study, it has become clear that the most pressing requirement of NPD is for information processing over a much wider spectrum of activities than covered by a conventional reliability bank. This is the programme now being pursued. Nevertheless, the lack of pertinent data is seen by the authors to be a major restriction on the use of quantitative risk and reliability techniques in the offshore industry. Current results suggest that the problem could be improved in the long term by the proper structuring of technical information systems to take account of reliability data requirements. A short term solution could be provided by collecting and publishing the best information currently available in the industry.

0206 Health And Safety

13382 **(PB—80-193816) Health hazard evaluation determination report no. 79-16-628, Ashland Petroleum Company, 2nd Avenue, Freedom, Pennsylvania.** Chrostek, W.J.; Frederick, L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Nov 1979. 18p. NTIS, PC A02/MF A01.

Environmental air sampling was performed and nondirect medical questionnaires were administered on March 6 and 7, 1979 at Ashland Petroleum Company, Freedom, Pennsylvania to determine if employees were exposed to bauxite (1318167) dust and unknown toxic substances. The benzene (71432) soluble fraction of polycyclic aromatic hydrocarbons (PPAH) measured 0.43 milligrams per cubic meter (mg/cu m) and exceeded the OSHA recommended exposure limit of 0.20mg/cu m in one of four sampling periods. Total dust particulates ranged from 1.1 to 8.5mg/cu m, lead (7439921) was undetectable, and sulfur dioxide (7446095) gas measured 3.1 micrograms/cu m. All were below their respective recommended limits of 15mg/cu m, 50mg/cu m, and 13mg/cu m. Medical reports of acute, intermittent irritation of the eyes and mucous membranes of the upper respiratory tract, dry skin, occasional headache, sinus congestion, and wheezing with exertion were associated with increased heat and with the burning of certain products that probably contained sulfur dioxide. The authors recommend periodic vacuum cleaning of the burner house, periodic maintenance

of the burner and ducts to seal leaks; a program of environmental sampling, preplacement and periodic medical examinations for exposed workers, maintaining medical records on all employees exposed for 1 or more years to sulfur dioxide, and a review of the value of the current preemployment practice of routinely recording lower back radiographs.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 13394, 14159

13383 **(DOE/PE/70278—T5) An attempt to explain the pricing of OPEC exports.** Fry, R. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). 8 Aug 1980. Contract AC01-80PE70278. 12p. NTIS, PC A02/MF A01.

A macroeconomic model which can be used to measure the macroeconomic costs of an oil import supply description is being developed. The model allows some insight into the benefits (or costs) of imposing an oil import tariff in the event of a disruption. Most of the impact of a disruption is on the price of the oil. An OPEC supply function is described which can determine the extent of the price rise resulting from a disruption.

13384 **(DOE/PE/70278—T9) Effect of the leasing schedule on exploration of the OCS.** Davidson, A. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 46p. NTIS, PC A03/MF A01.

The effects of the leasing schedule on the optimal exploration strategy are explored. First, the effects of the leasing schedule on drilling strategies for two areas of the OCS with identical estimates on the probability of success before drilling but with different degrees of certainty about the accuracy of those estimates are discussed. Then two areas with identical distributions of the prior probabilities of success are considered. Subsequently, two areas with different distributions of the prior probability of success are evaluated. Throughout the analysis, the value of the oil produced from a successful well and the costs of drilling an exploration well are identical for any well drilled in either area. Appendix A gives a description of the dynamic programming formulation of the model used in this analysis. Appendix B describes an example of the use of the dynamic programming model to evaluate the effects of the leasing schedule on the allocation of firms resources to exploration over time. Appendix C offers a simple (nonquantitative) discussion of the effect of the leasing schedule on a firm manager's ability to make optimal drilling decisions. The announcement of the most recent OCS five-year leasing schedule is in Appendix D. Characteristics of the Beta distribution, which is used in the dynamic programming model, are discussed in Appendix E.

13385 **(JPRS—75653) Near East/North Africa report, No. 2113, 'oil and domination' by Abol Hasan Bani-Sadr.** (Joint Publications Research Service, Washington, DC (USA)). 8 May 1980. Translation of Naft Va Solteh, n.p., p1-200, 29 Aug 1977. 222p. NTIS PC E03/MF A01.

A partial listing of topic areas includes: Role of oil in the Iranian economy; Oil's place in the economic future of Iran and the world; The role of oil in the industrial economies; Different types of oil companies in the activities of the industrial economies; Capital formation and attraction; The effects of capital on the orientations of dominant and dominated economies; Deception in oil prices and the transfer movement of oil revenues.

13386 **(PB—80-209802) The CTARP energy facility siting study. Volume II. Impact analysis and case studies.** McAlister, J.T. Jr.; Roughgarden, J.D. (Stanford Univ., CA (USA). Center for Technology Assessment and Resource Policy). Apr 1979. 408p. NTIS, PC A18/MF A01.

The second volume of a four volume study discusses the business of analyzing the effects of energy facility siting. It sets forth a conceptual framework for and philosophy of analysis, establishing criteria for good analysis. It also discusses some of the problems of analysis within a strategic contest and the role of analysis in a multiparty decision process. The philosophical discussion is brought down to earth by presenting a demonstration of the techniques advocated. Specifically, the demonstration analyzes the proposed Outer Continental Shelf (OCS) lease sale No. 48, off the shore of southern California, and discusses what each of the major participants in the controversy surrounding the lease sale stands to gain or lose.

0208 Waste Management

13387 **(PB—80-813306) Waste processing and pollution in the chemical and petrochemical industries. 1978-June 1980 (citations from the NTIS Data Base). Report for 1978-June 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 285p. NTIS PC N01/MF N01.

These citations from Federally funded research cover many aspects of waste processing and pollution in the chemical and petrochemical industries. The bibliography includes emissions, economics, control processes, pollution effects, and abatement strategies. (This updated bibliography contains 280 citations, 89 of which are new entries to the previous edition.)

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 13387, 13403, 14651, 14709, 14780, 14791, 14793, 14798

13388 **(PB—80-177454) Oil spill debris - where to put the waste. Final report.** Farlow, J.S.; Wilder, R.; Potter, C. (Environmental Protection Agency, Cincinnati, OH (USA). Industrial Environmental Research Lab.). Jan 1980. 98p. NTIS, PC A05/MF A01.

This report is a digest of a workshop on disposal of oil spill debris. Representatives of five New England states and New York agreed that oil spill cleanup and disposal of debris is a major regional problem which must be addressed by identifying disposal sites in advance of major oil spills. The workshop provided a forum for discussion of state oil spill clean up and disposal and EPA's policies and plans for regulating clean up operations. A representative from each of the six states reviewed existing laws and regulations governing oil-debris stockpiling, transportation to disposal sites, and the relation between state and local ordinances on liability for disposal costs. Ultimate responsibility for oily debris transportation and disposal varies from state-to-state, and this in turn affects approaches to identifying acceptable disposal sites.

13389 **(PB—80-179302) Ambient hydrocarbon and ozone concentrations near a refinery, Benicia, California, 1975. Final report.** Sexton, K.; Westberg, H. (Washington State Univ., Pullman (USA)). Feb 1980. 214p. NTIS, PC A10/MF A01.

As part of an effort to characterize airborne emissions from petroleum refineries, an ambient air monitoring study was conducted near the Exxon refinery at Benicia, California, during September 8-22, 1975. Ground-level sampling facilities and an airplane equipped with air pollutant monitoring instruments provided an integrated, three dimensional monitoring network. Measurements included ozone, oxides of nitrogen, methane, carbon monoxide, individual C2-C6 hydrocarbons, halocarbons, condensation. Increased concentrations of hydrocarbons, carbon monoxide, condensation nuclei and nitrogen oxides, as well as decreased ozone levels were observed less than five miles from the refinery. At distances greater than 5 miles, elevated condensation nuclei and hydrocarbons were still observed but no discernible differences from background could be detected in NOx, O3, and CO.

13390 **(PB—80-181928) The economic impact of vapor control regulations on the bulk storage industry. Final report.** McCarthy, R.J. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jun 1979. 243p. NTIS, PC A11/MF A01.

The U.S. Environmental Protection Agency (EPA) is considering regulations which would control total benzene emissions on a national basis. A significant portion of these benzene emissions is contained in the gasoline vapors released during the normal gasoline transfer operations of petroleum bulk terminals and bulk plants.

This report assesses economic impacts of several vapor control strategies which would reduce the benzene emissions of the bulk storage industry. The report seeks to: Identify and characterize the bulk storage industry; Determine the number of facility closures expected to occur because of the proposed vapor control regulations; Estimate the employment levels displaced by these closures; and, Calculate the national cost of installing and operating vapor control systems in the remaining bulk storage population.

13391 **(PB—80-183585) Oil spills: a coastal resident's handbook.** Omohundro, J.T. (New York State Coll. of Agriculture and Life Sciences, Ithaca (USA)). Mar 1980. 16p. NTIS, PC A02/MF A01.

People living on or using the water bodies within and bordering New York State will find this bulletin valuable in case of a spill emergency. Knowledge of what can happen and what can be done in case of a spill emergency may save needless confusion, anxiety, and loss or damage. The first half of this bulletin explains what happens in a spill and what official parties will do. The self-help advise in the second half of this bulletin may reduce loss and damage to property owners or sportsmen on Lake Erie, Lake Ontario, the Saint Lawrence Seaway, Lake Champlain, the Hudson River, the Barge Canal System, New York Harbor, Long Island Sound or the Atlantic Ocean. The bulletin should be kept handy as a reference in time of emergency.

13392 **(PB—80-193139) Report of the governor's task force committee on the environment, environmental issues related to energy resource development in New Mexico.** (New Mexico Governor's Energy Task Force, Santa Fe (USA)). 25 May 1975. 97p. NTIS, PC A05/MF A01.

This report analyzes present and future environmental issues in energy-related developments. It describes in detail the main pollutants, discussing their emission by present, planned and proposed developments, and analyzes the problems of specific areas in the state and the role of New Mexico's scarce water resources. Recent Federal regulations are analyzed, and an extensive set of recommendations is given.

13393 **(PB—80-194632) Hydrocarbon control strategies for gasoline marketing operations.** Norton, R.L.; Sakaida, R.R.; Yamada, M.M. (Pacific Environmental Services, Inc., Santa Monica, CA (USA)). May 1978. Contract EPA-68-02-2606. 128p. NTIS, PC A07/MF A01.

This informational document provides basic and current descriptions of gasoline marketing operations and methods that are available to control hydrocarbon emissions from these operations. The three types of facilities that are described are terminals, bulk plants, and service stations. Operational and business trends are also discussed. The potential emissions from typical facilities, including transport trucks, are given. The operations which lead to emissions from these facilities include (1) gasoline storage, (2) gasoline loading at terminals and bulk plants, (3) gasoline delivery to bulk plants and service stations, and (4) the refueling of vehicles at service stations. Available and possible methods for controlling emissions are described with their estimated control efficiencies and costs. This report also includes a bibliography of references cited in the text, and supplementary sources of information.

0210 Legislation And Regulation

13394 **(DOE/PE/70278—T8) Legislative history of the crude oil windfall profit tax.** Bergman, T. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 24p. NTIS, PC A02/MF A01.

This paper looks at the history of the crude oil windfall profits tax program from the completion of the administration proposal to the passage of the final conference bill. The administration's proposal, House action, Senate action, and the final bill are described.

13395 **(PB—80-196694) A study of federal and state legislation concerning the construction of proposed oil refineries. Working paper.** Grant, C.; Earnhardt, T.W. (North Carolina State Univ., Raleigh (USA). Sea Grant Coll. Program). Feb 1980. 33p. NTIS, PC A03/MF A01.

Two oil refineries are proposed for construction in Brunswick and Carteret counties, North Carolina. The economic benefits to the coastal area will be substantial. These benefits are welcome by county officials, chamber of commerce members, and state government officials. Yet, environmentalists, citizens, and state officials wish to insure that the operations are as safe as possible. To assist in shedding some light on the possible problems, this study examines how effectively federal and state regulations relative to the construction and operation of oil refineries, assess and alleviate any possible adverse impacts. Any deficiencies in the regulations are identified and possible solutions are discussed.

0220 Transport, Pipelines, And Handling

13396 **(PB—80-204514) Quarterly report (1st) to the President and Congress on the construction of the Alaska Natural Gas Transportation System. Report for July-September 1979.** (Office of the Federal Inspector for the Alaska Natural Gas Transportation System, Washington, DC (USA)). Oct 1979. 30p. NTIS, PC A03/MF A01.

This report discusses the progress made during the fourth quarter FY '79 on the Alaska Natural Gas Transportation System. It includes background and historical data regarding the project.

13397 **(PB—80-204522) Quarterly report (2nd) to the President and Congress on construction of the Alaska Natural Gas Transportation System. Report for October-December 1979.** (Office of the Federal Inspector for the Alaska Natural Gas Transportation System, Washington, DC (USA)). Jan 1980. 19p. NTIS, PC A02/MF A01.

This report discusses progress made during the first quarter of FY '80 on the Alaska Natural Gas Transportation System.

13398 **(PB—80-204530) Quarterly report (3rd) to the President and Congress on construction of the Alaska Natural Gas Transportation System. Report for January-March 1980.** (Office of the Federal Inspector for the Alaska Natural Gas Transportation System, Washington, DC (USA)). Apr 1980. 24p. NTIS, PC A02/MF A01.

This report discusses progress made during the second quarter FY '80 on the Alaska Natural Gas Transportation System.

13399 **(PB—80-812977) Supertankers and superports. 1964-June 1980 (citations from the NTIS Data Base). Report for 1964-June 1980.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 209p. NTIS PC N01/MF N01.

Construction and operation of supertankers and requirements for port facilities are reviewed in these Government-sponsored research reports. The environmental aspects are investigated. (This updated bibliography contains 204 citations, 17 of which are new entries to the previous edition.)

13400 **(PB—80-812985) Supertankers and superports. 1970-June 1980 (citations from the Engineering Index Data Base). Report for 1970-June 1980.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 126p. NTIS PC N01/MF N01.

Construction and operation of supertankers and requirements for port facilities are reviewed in these reports gathered from worldwide literature surveys. Environmental aspects, offshore mooring sites, and harbor preparation are among the features investigated. (This updated bibliography contains 121 citations, 5 of which are new entries to the previous edition.)

0230 Properties

REFER ALSO TO CITATION(S) 13315, 13360, 14362

13401 **(PB—80-187388) Quantitative analysis of polynuclear aromatic hydrocarbons in liquid fuels. Final report Oct 76-Oct 78.** Parr, J.L. (Radian Corp., Austin, TX (USA)). Apr 1980. Contract EPA-68-02-2466. 44p. NTIS, PC A03/MF A01.

Polynuclear aromatic hydrocarbons (PNAs), formed in combustion processes with liquid hydrocarbon fuels, contribute to mobile source exhaust emissions. Because correlation between PNA levels in automobile exhaust and pre-existent PNAs in fuel has been demonstrated in previous work, a quantitative analysis of 12 individual polynuclear aromatic hydrocarbons present in various aircraft turbine, diesel, and gasoline test fuels was determined in this project. The PNAs included phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, triphenylene, benzo(a)pyrene, benzo(e)pyrene, benzo(g,h,i)perylene, coronene and anthanthrene. The fuel samples were analyzed by combined gas chromatography/mass spectrometry (GC-MS) after a preliminary isolation/concentration scheme. Liquid crystal chromatographic columns were employed to resolve isomeric PNAs. The results indicated that anthanthrene and coronene were not detected in any of the samples analyzed.

13402 **(PB—80-189053) Thermodynamic properties of liquefied petroleum gases (LPG). Interim report 15 Aug 75-31 Jan 77 (final).** Sallet, D.W.; Wu, K.F. (Maryland Univ., College Park (USA). Dept. of Mechanical Engineering). Apr 1980. Contract DOT-FR-64181. 111p. NTIS, PC A06/MF A01.

The thermodynamic properties of several liquefied petroleum gases (with particular emphasis on propane) are discussed in detail. It is concluded that the widely used propane data by Stearns and George are too inconsistent and too inaccurate to be used for mass flow calculations of propane and propane mixtures through safety valves of rail tank cars. Accordingly, the thermodynamic properties of propane, propylene, n-butane, and a mixture of 65% (by mole) propane, 25% propylene, and 10% n-butane are recalculated using equations of states proposed by Benedict-Webb-Rubin (BWR) and by Starling. It is shown that Starling's equation results in thermodynamic properties which are more consistent and compare better with measured values than the BWR equation. Thermodynamic data for the four liquefied petroleum gases discussed above are calculated and presented in tabular form. In addition, predictions of pure propane mass flow rates (based upon isentropic), homogeneous equilibrium flow) are given. The influence of the thermodynamic data upon the predicted mass flow rates is demonstrated.

0240 Storage

13403 **(DOE/PO/10114—3) Evaluation of brine disposal from the Bryan Mound Site of the Strategic Petroleum Reserve Program. Final report of predisposal studies. Chapter 4. Appendix 7.** Hann, R.W. Jr.; Randall, R.E. (eds.). (Texas A and M Univ., College Station (USA). Research Foundation). Feb 1981. Contract FC96-79PO10114. 179p. NTIS, PC A09/MF A01.

This report describes nekton communities off Freeport, Texas prior to brine disposal based on trawl studies in the period October 1977 to February 1980. Trawling was conducted aboard chartered commercial shrimp trawlers along a transect in depths of 3 to 25 fathoms to describe the general background of nekton communities off Freeport. An array of stations were occupied at the diffuser site in 12 fathoms of water to describe in detail nekton communities near the diffuser. Collections at each station, in general, were made once a month during the day and once a month at night, cruises being about two weeks apart in time. Projected diffuser locations, stations occupied, etc., changed during the course of the project, and the Materials and Methods (Section 4.2) should be consulted for details.

13404 **(SAND—80-7131) Strategic Petroleum Reserve (SPR) site characterization report, West Hackberry salt dome: Section I; Section II; and Section III.** Whiting, G.H. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Jan 1981. Contract AC04-76DP00789. 327p. NTIS, PC A15/MF A01.

This report is composed of the following three sections: (1) West Hackberry Cavern Stability Issues; (2) Geological Site Characterization, West Hackberry Salt Dome; and (3) Salt Properties for West Hackberry Dome. Section one reviews cavern stability, integrity, and usability issues regarding existing and planned storage caverns in the West Hackberry salt dome. Previous studies are discussed, ongoing investigations are summarized and data needed to support the assessment are described. Section two is a comprehensive site characterization study done by Woodward-Clyde consultants for Sandia. The geological characterization was to be done in two phases. In the first phase, a comprehensive study would be prepared from existing data, and in the second phase, field programs would be used to gather specific information as needed. Section two represents the results of Phase 1 only. Section three evaluates the properties of salt from the West Hackberry salt dome. The evaluation includes review of core, borehole logs and drilling reports to determine typical material properties and define anomalies. The typical quasi-static and creep properties of the salt are consistent with published values for salt from many worldwide locations. The typical impurities in this dome are anhydrite-halite layers with near vertical dip. Small quantities of anhydrite are also dispersed within the salt grains. The salt dome is suitable for the long-term storage for petroleum in caverns which can be constructed using normal leaching techniques.

13405 **(SAND—81-0163) Evaluation of the oil storage capabilities of SPR leaching strategies.** Shefelbine, H.C. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1981. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01.

This report examines techniques for comparing the oil storage capabilities of selected leaching strategies for Strategic Petroleum Reserve caverns. In particular the area under the oil volume versus time curve is used as a measure for comparing options. The use of the techniques is illustrated by analyzing two cases. In one case five alternatives for leaching the 12 Phase II caverns at Bryan Mound are examined. The other case examines two alternatives for developing the 490 MMB of oil storage planned for Phases II and III.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 14198

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 13373, 13376

13406 **(DOE/ET/12138—T1(Vol.2)) Analysis of the structural parameters that influence gas production from the Devonian shale. Annual progress report, 1979-1980. Volume II. Data repository and reports published during fiscal year 1979-1980: regional structure, surface structure, surface fractures, hydrology.** Negus-De Wys, J.; Dixon, J.M.; Evans, M.A.; Lee, K.D.; Ruotsala, J.E.; Wilson, T.H.; Williams, R.T. (West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography). Oct 1980. Contract AC21-76ET12138. 616p. NTIS, PC A99/MF A01.

This volume comprises appendices giving regional structure data, surface structure data, surface fracture data, and hydrology data. The fracture data covers oriented Devonian shale cores from West Virginia, Ohio, Virginia, Pennsylvania, and Kentucky. The subsurface structure of the Eastern Kentucky gas field is also covered. (DLC)

13407 **(DOE/ET/12138—T1(Vol.3)) Analysis of the structural parameters that influence gas production from the Devonian shale. Annual progress report, 1979-1980. Volume III. Data repository and reports published during fiscal year 1979-1980: production, unsponsored research.** Negus-De Wys, J.; Dixon, J.M.; Evans, M.A.; Lee, K.D.; Ruotsala, J.E.; Wilson, T.H.; Williams, R.T. (West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography). Oct 1980. Contract AC21-76ET12138. 597p. NTIS, PC A25/MF A01.

This document consists of the following papers: inorganic geochemistry studies of the Eastern Kentucky Gas Field; lithology studies of upper Devonian well cuttings in the Eastern Kentucky Gas Field; possible effects of plate tectonics on the Appalachian Devonian black shale production in eastern Kentucky; preliminary depositional model for upper Devonian Huron age organic black shale in the Eastern Kentucky Gas Field; the anatomy of a large Devonian black shale gas field; the Cottageville (Mount Alto) Gas Field, Jackson County, West Virginia: a case study of Devonian shale gas production; the Eastern Kentucky Gas Field: a geological study of the relationships of Ohio Shale gas occurrences to structure, stratigraphy, lithology, and inorganic geochemical parameters; and a statistical analysis of geochemical data for the Eastern Kentucky Gas Field.

0303 Drilling, Production, And Processing

13408 **(DOE/BC/10003—16) Western Gas Sands Project: production histories of the Piceance and Uinta basins of Colorado and Utah.** Anderson, S.; Kohout, J. (comp.). (CER Corp., Las Vegas, NV (USA)). 20 Nov 1980. Contract AC08-79BC10003. 35p. NTIS, PC A03/MF A01.

Current United States geological tight sand designations in the Piceance and Uinta Basins' Western Gas Sands Project include the Mesaverde Group, Fort Union and Wasatch Formations. Others, such as the Dakota, Cedar Mountain, Morrison and Mancos may eventually be included. Future production from these formations will probably be closely associated with existing trends. Cumulative gas production through December 1979, of the Mesaverde Group, Fort Union and Wasatch Formations in the Piceance and Uinta Basins is less than 275 billion cubic feet. This contrasts dramatically with potential gas in place estimates of 360 trillion cubic feet. If the geology can be fully understood and engineering problems surmounted, significant potential reserves can be exploited.

13409 **(PB—80-205305) Survey of coal industry programs for utilization of methane from coal seams. Final report, 31 March-31 October 1979.** Uhrin, D.C.; du Breuil, F.; Saltsman, R.D. (Bituminous Coal Research, Inc., Monroeville, PA (USA)). 14 Feb 1980. Contract GRI-5010-380-0164. 39p. NTIS, PC A03/MF A01.

The purpose of this study was to determine the activity in the private sector of the United States regarding removal and utilization of coalbed methane. An attempt was made to learn to what extent and for what purposes coalbed methane is currently being used, what experimental programs exist, and what programs are planned or proposed. Information was obtained primarily from interviews with coal industry personnel familiar with the subject of recovery of methane from coalbeds. Methods presently used or under investigation in the United States for removing methane from coalbeds are briefly described, and factors to consider when planning methane removal are presented. The study identifies various obstacles that must be overcome for methane removal techniques to become routine procedures and for the methane captured to become attractive as a fuel.

0305 Health And Safety

REFER ALSO TO CITATION(S) 14163

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 13386

13410 **(PB—80-203847) Alternative energy futures. Part 1 - background reports. The future of liquefied natural gas imports.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Mar 1980. 435p. NTIS, PC A19/MF A01.

Contents: Future demand for gas--implications for LNG policy; North American oil and gas resources and production potential; Imported liquefied natural gas--projects, supply, consumption.

13411 **(PB—80-205420) An evaluation of natural gas supply and demand models. Final report, October 1978-October 1979.** Fletcher, A.L. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Dec 1979. Contract GRI-5011-381-0084. 184p. NTIS, PC A09/MF A01.

The report is a detailed evaluation of all major natural gas supply, demand, and integrating models. The purpose of the analysis was to understand the capabilities and limitations of each model, in order to determine how each could be utilized in support of GRI's planning and evaluation activities. The final report identifies the major technical and management issues associated with these models and presents an outline of a plan for modeling and analytical support for GRI.

13412 **(PB—80-812993) Natural gas: supply, demand and utilization. 1978-June 1980 (citations from the NTIS Data Base). Report for 1978-June 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 186p. NTIS PC N01/MF N01.

Abstracts pertaining to natural gas supply and demand, industrial and residential consumption, fuel substitution, availability, costs, Government policies, and regulations are presented. Studies dealing with projections of natural gas use and the economics of supply and demand are included. (This updated bibliography contains 178 citations, 71 of which are new entries to the previous edition.)

0308 Environmental Effects

13413 **(PB—80-187958) Multimedia assessment of the natural gas processing industry. Final report Sep 77-Nov 78.** Wade, W.A. III. (TRC Environmental Consultants, Wethersfield, CT (USA)). Apr 1979. Contract EPA-68-02-2615. 147p. NTIS, PC A07/MF A01.

The report gives results of an assessment of the air and water pollution potential of the natural gas processing industry, based on a review of publicly available literature. It reviews natural gas processing operations and discusses the potential air and water emissions from the industry. It describes acid gas removal, dehydration, purification, and stripping unit operations, primarily to indicate their potential for air and water pollution. It presents historical production data and discusses future trends in applications of new techniques. It reviews Federal and State regulations affecting the industry and discusses their limitations and reporting requirements. It discusses the impact of the myriad rules, regulations, and reporting requirements on obtaining quantifiable data on the industry. It estimates air emissions for each criteria pollutant for the industry nationwide, as well as for Texas and Louisiana, the two largest producing states. It shows the significance of emissions from natural gas processing operations relative to other industrial sectors. It compares these estimates with overall mass balance calculations based on published production and distribution data. It discusses, generally, the water pollution potential of the industry and describes shortcomings in available data.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 14201

13414 **Unconventional gas sources. Volume V. Tight gas reservoirs. Part I.** Washington, DC; National Petroleum Council (1980). 474p. (DOE/TIC—11418).

The findings set forth in this report form the basis for the following specific conclusions: the amount of tight gas expected to be recoverable is very large. The potential production of natural gas from tight reservoirs is estimated to be sufficient to increase US gas production substantially above present levels. Exploration and development of tight gas resources involve risk and uncertainty. Much tight gas will be discovered and can begin to be produced above current levels at the Federal Energy Regulatory Commission incentive ceiling price. Development of the US tight gas resource will be as dependent on advances in technology and changes in well spacing rules as on price. Tight gas is widespread in favorable formations, but it is most economically attractive in areas of thicker, more permeable rocks. There is a major opportunity to recomplete old wells, otherwise ready for abandonment, into profitable producers of gas from tight formations. Initially, new tight gas formation is expected to come from basins in the southwest region. Development of the US tight gas reservoirs should have a minimal impact on the environment compared to the development of other energy forms.

0320 Transport, Pipelines, And Handling

13415 **(PB—80-812951) Natural gas: marine transportation. 1964-June, 1980 (citations from the NTIS data base). Report for 1964-June 1980.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 153p. NTIS PC N01/MF N01.

Abstracts are presented of studies on various aspects of marine transportation of liquefied natural gas. This includes reports on forecasts, cargo tank design, terminal facilities, spills, safety aspects, special tanker design, and handling equipment. (This updated bibliography contains 143 citations, 8 of which are new entries to the previous edition.)

0330 Properties

13416 **(PB—80-205362) Boiling of LNG on typical dike floor materials. Final report, September 1975-September 1979.** Reid, R.C. (Massachusetts Inst. of Tech., Cambridge (USA). Liquefied Natural Gas Research Center). Mar 1980. Contract GRI-5014-353-0160. 150p. NTIS, PC A07/MF A01.

Boiling rates of LNG and liquid methane were measured for various substrates which are or could be used as dike floor materials. These rates were correlated with theoretical heat transfer models to allow interpolation and extrapolation. Two very effective insulations were identified: A proprietary insulating concrete and corrugated metal plates. The former has very low density, is quite strong, and has a low thermal conductivity. The latter is inexpensive, easily placed into position and leads to quite low boiling rates. Also shown was the fact that LNG vaporizing on a solid surface is in vapor-liquid equilibrium and, therefore, standard thermodynamic correlations may be used to estimate the composition of the evolved cloud.

0350 Storage

13417 **(PB—80-205339) Numerical and physical experiments in double-diffusive convection: a lateral heat flux imposed on a vertical concentration gradient. Final report, January 1977-December 1979.** Griffis, K.A.; Smith, K.A. (Massachusetts Inst. of Tech., Cambridge (USA). Liquefied Natural Gas Research Center). Dec 1979. Contract GRI-5010-352-0011. 39p. NTIS, PC A03/MF A01.

It has been concluded that stratified cells will readily form in an LNG tank as a result of side wall heat leak unless the tank contents are initially very well mixed. Mixing, unless it is very good, only slightly mitigates the long term roll-over potential which is present when LNG is transferred to a tank which already contains an LNG of a different composition. Two mechanisms of cell formation are found to exist and are correlated in terms of a single stability parameter. If a single tank is to be used for the storage of an LNG for which the composition may vary, it is recommended that all LNG transfers be done in a manner to produce excellent mixing. For those circumstances in which strata are formed, perhaps as a result of operator error, it is believed that technical effort should now be directed at the issue of the rates at which heat and mass are transferred between strata.

04 OIL SHALES AND TAR SANDS

13418 **(PB—80-810351) Oil shale mining, processing, uses, and environmental impacts. 1978-April, 1980 (citations from the NTIS data base). Report for 1978-April 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). May 1980. 213p. NTIS PC N01/MF N01.

Government-funded research on exploration, mining, retorting, chemistry, environmental impacts, and policies relating to oil shale research is covered. Abstracts discuss such things as oil shale air and water pollution control, production of synthetic fuels, use of spent oil shale in road construction, identification of research and development priorities, and in situ recovery of shale oil. (This updated bibliography contains 206 abstracts, 95 of which are new entries to the previous edition.)

13419 **(PB—80-810369) Oil shale mining, processing, uses and environmental impacts. 1978-April, 1980 (citations from the Engineering Index data base). Report for 1978-April 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). May 1980. 185p. NTIS PC N01/MF N01.

Worldwide research on exploration, mining, retorting, chemistry, thermal studies, environmental impacts, and policies relating to oil shale research is discussed. A few abstracts deal with the production of synthetic fuels from shale oil and the economics of oil shale operations. (This updated bibliography contains 178 abstracts, 65 of which are new entries to the previous edition.)

13420 **(PB—80-813181) Oil shale mining, processing, uses, and environmental impacts. 1977-April 1980 (citations from the American Petroleum Institute Data Base). Report for 1977-April 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 275p. NTIS PC N01/MF N01.

Worldwide research on exploration, mining, retorting, chemistry, thermal studies, and environmental impacts relating to oil shale development is discussed. A few abstracts deal with the production of synthetic fuels from shale oil and the economics of oil shale operations. (This updated bibliography contains 269 citations, 105 of which are new entries to the previous edition.)

0404 Oil Production, Recovery, And Refining

13421 **(DOE/ET/14102—1) Synthetic fuels from US oil shales: a technical and economic verification of the HYTORT Process. Project 61040 quarterly report, April 1-June 30, 1980.** (Institute of Gas Technology, Chicago, IL (USA)). Nov 1980. Contract AC20-79ET14102. 96p. NTIS, PC A05/MF A01.

Progress is reported on the HYTORT Process development work conducted from April 1 through June 30, 1980. Thermobalance tests have been conducted on samples of shale from each large multiton sample prior to large-scale tests and these test results have been fit with specific kinetic expressions. Approximately 80% of the instrumentation for the laboratory-scale reactor has been received. Fabrication of the reactor, feed hopper, and residue receiver is about 95% complete. Two successful moving-bed tests were conducted in the bench-scale reactor during this quarter. A large, 50-ton sample of the Lower Huron member of the Ohio Shale was mined and readied for shipment to IGT. Modification of the bench-

scale steam-oxygen unit was completed. Spent shale from PDU tests was prepared for use in these tests. A set of five screening runs on New Albany shale oil and a set of four screening runs on Sunbury shale oil were conducted during this quarter. The nitrogen content of these oils was reduced to the 0.16 to 0.30 weight percent range in the bench-scale hydrotreating unit. Design of the laboratory test system for mist-size control studies was completed. Methods are being studied for measuring mist particle size. Shakedown and initial testing of the liquid-sealed lockhopper were performed during this quarter. Two runs were made in the PDU with Kentucky shales using a sample of the Cleveland member of the Ohio shale and a sample of New Albany shale. Samples for environmental analysis were taken during the PDU runs discussed above. On-line sampling equipment was installed prior to the PDU run with New Albany shale and samples were taken of the Stage 2 raw product gases.

13422 **(SAND—80-2572) Model capabilities for in-situ oil shale recovery.** Hommert, P.J.; Tyner, C.E. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1981. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01.

The extensive oil shale reserves of the United States are now under development as an energy source. One of the approaches for extracting oil from shale is the so called modified in-situ retort. The operation of such retorts for maximum yield requires an understanding of oil loss mechanisms so that operating strategies that minimize these losses can be developed. The present modeling capabilities for describing the behavior and yield from a modified in-situ retort are discussed. It is shown how the advances made in describing retort chemistry have greatly increased the predictive capabilities of these models. Two models that have been subject to comparison with laboratory retorts are described. The first is a one-dimensional model that treats the retort as a packed bed reactor, the second is a quasi-two-dimensional examination of block retorting. Both models are capable of predicting retorting rates, off gas composition and oil yield losses to coking and combustion. The block model, for example, describes conditions where local oil yield losses can be as high as 50%. Areas for further model improvement include additional work on describing retort chemistry, such as the steam/char and gas phase combustion reactions. The major need for modeling now is expansion to multi-dimensional simulation. This is necessary if a predictive capability is to be developed for field situations where sweep efficiency losses and gravitational effects become important.

13423 **(SAND—81-0182) Tar sands program FY80. Third quarterly report, July 1980.** Wayland, J.R.; Mulac, A.J.; Fox, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1981. Contract AC04-76DP00789. 17p. NTIS, PC A02/MF A01.

This report documents Sandia National Laboratories' activities during the third quarter, FY80, in the reservoir access and alternate extraction concepts subprograms of the Laramie Energy Technology Center's Tar Sands Program. Progress towards establishment of a training course for tar sands well drilling is covered, and a workshop on permeability enhancement of tar sands is described. A controlled-source audio magnetotelluric survey is briefly described, and progress on steam-quality measurement tools is documented. The status of investigations into radio-frequency/microwave heating of tar sands is presented, and the report concludes with a brief account of laboratory tests of tar sands' basic physical properties.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 13559

0406 Direct Uses And By-products

REFER ALSO TO CITATION(S) 13360

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 14203

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 13427

13424 **(PB—80-179138) Natural cementation of retorted oil shale. Final report, February 1978-May 1979.** Farris, C.B. (Colorado School of Mines, Golden (USA). Research Inst.). May 1979. 131p. NTIS, PC A07/MF A01.

Retorted oil shale possesses an inherent cementation characteristic which develops when the shale is moistened, compacted, and cured. The degree of strength is strongly dependent upon retorting temperature, residence time, and mode of bed heating. A high natural cementation strength can be beneficial in reducing costs of surface disposal of retorted shale, in using retorted shale as an engineering construction material, and possibly in reducing water pollution. The natural cementation strength of retorted oil shale is the focus of this investigation. The optimum retorting temperature and residence time to obtain natural cementation strength in retorted Green River oil shale from western Colorado were determined.

13425 **(PNL-SA—9086) Retort water-treatment alternatives.** Mercer, B.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 17 Nov 1980. Contract AC06-76RL01830. 9p. (CONF-801245—1). NTIS, PC A02/MF A01.

From EPA/DOE workshop on shale oil wastewater disposal; Denver, CO, USA (2 Dec 1980).

Some of the alternative methods for treatment and disposal of shale oil retort water are reviewed: land treatment and disposal, underground injection, suspended solids removal, steam stripping, biological treatment, adsorption of organics. Effluents from various treatment steps in the bench-scale studies were analyzed for heavy metals and boron. Preliminary cost estimates are given for physical-chemical and biological treatment processes. Average compositions of bench-scale evaporator inputs and outputs are given; bench-scale studies on biological and activated carbon treatment were also conducted. 1 figure, 3 tables. (DLC)

0410 Enviromental Aspects

13426 **(LA—8678-MS) Assessment and control of water contamination associated with shale oil extraction and processing. Work plan, October 1, 1980-September 30, 1981.** Wagner, P.; Peterson, E.J. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 17p. NTIS, PC A02/MF A01.

The work plan for the Los Alamos National Laboratory's research on assessment and control of water contamination associated with shale oil extraction and processing is updated. There are two technical tasks in the program; the assessment of potential water contamination problems and the identification of alternative control strategies for controlling contaminant release into the surface and underground water systems from various oil-shale-related sources. Emphasis is currently placed on problem definition with future activities to stress the control of potential problems. Assessment activities include the physical and chemical characterization of solid and liquid process effluents and their potential for contaminant release, while current control technology researches are focussed on retort abandonment strategies.

13427 **(LBL—6300) Water-related impacts of in-situ oil shale processing.** Fox, J.P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1980. Contract W-7405-ENG-48. 350p. NTIS, PC A15/MF A01.

This study discusses the water-related impacts of an in-situ oil shale industry located in the Upper Colorado River Basin. It focuses on a 50,000 barrel per day industry based on the modified in-situ process and located in the Piceance Creek Basin, Colorado. It reviews the history of oil shale development in the United States

and the reserves, geology, and characteristics of domestic oil shales. In-situ technologies that have been tested or are under active consideration for commercialization are reviewed, and their commercial potential is evaluated. The existing hydrology and water quality of the Upper Colorado River Basin is surveyed as is water use and the statuatory framework for water availability and water quality for in-situ oil shale development. The major environmental problem of in-situ processing, groundwater disruption from in-situ leachates and large-scale dewatering, is analyzed, pertinent experimental results are summarized and interpreted, and recommendations are made for additional research. Methods to control groundwater disruption are identified and discussed and preliminary cost projections are developed. Finally, the reuse, treatment and disposal of effluents produced by in-situ retorting - retort water, gas condensate, mine waters, and others - are discussed.

13428 **(PB—80-179112) Oil shale mining environmental research program overview. Final report, September 1978-June 1979.** Ogasawara, C.; Kuncir, G.F.; Lewis, D.A. (Aerospace Corp., El Segundo, CA (USA). Energy and Resources Div.). Jun 1979. 64p. NTIS, PC A04/MF A01.

This report describes the direction and progress of the Bureau of Mines Oil Shale Mining Environmental Research Program as of January 31, 1979. The report focuses on the Bureau's role in environmental research supporting oil shale development with respect to the activities of other involved Government agencies and private industry. Environmental considerations in oil shale extraction, such as ecological disturbances, health and safety hazards, waste management, and socioeconomic impacts, are discussed along with the type of research known to be planned by organizations to ameliorate these problems.

05 NUCLEAR FUELS

0501 Reserves

13429 **(GJBX—1(81)) Geology and recognition criteria for roll-type uranium deposits in continental sandstones. Final report.** Harshman, E.N.; Adams, S.S. (Adams (Samuel S.) and Associates, Boulder, CO (USA)). Jan 1981. Contract AC13-76GJ01664. 81p. NTIS, PC A05/MF A01.

The study of roll-type deposits during the past 20 years, since the first description of a deposit in the United States, has developed general concepts of ore formation which are accepted widely and are compatible with available data. If this were not the case the concepts would not have endured and could not have been so successfully applied to exploration using the relations of altered-unaltered sandstone. The comparative simplicity of the model, and the ease with which it has been applied to exploration have, oddly enough, probably inhibited detailed studies of ore districts that would have provided data now needed for refinement of ore controls for exploration and resource assessment programs. The most thorough study of a roll-type district was that of the Shirley Basin which is drawn on heavily in this report. The general concept of roll-type formation provides a strong basis for the development of geological observations and guides, or recognition criteria, for resource studies and exploration. Indeed, industry has been developing and using them for 20 years. As the objective of this study was to identify the most useful recognition criteria and develop a method for their systematic use in resource studies and exploration, the study is best summarized by reference to the important geological observations about roll-type deposits.

0502 Exploration

13430 **(GJBX—10(81)) OREDIT: a fortran computer program to process Oak Ridge HSSR data.** Zinkl, R.J.; D'Andrea, R.F. Jr.; Shettel, D.L. Jr. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Jan 1981. Contract AC13-76GJ01664. 32p. NTIS, PC A03/MF A01.

A FORTRAN program is presented that will read, edit, and sort the Hydrogeochemical and Stream-Sediment Reconnaissance (HSSR) data produced by the Oak Ridge Gaseous Diffusion Plant for the National Uranium Resource Evaluation program. The data are sorted into groups of stream-sediment, stream-water, and ground-water samples. Extraneous information is eliminated, and missing analyses are assigned a specific value. The output from this program consumes considerably less disk space than the original, unsorted, data file. Allowances are made for elemental analyses not currently performed by ORGDP, so that the program is not likely to become obsolete.

13431 **(GJBX—11(81)) FORTRAN computer programs to read, sort, and edit Los Alamos hydrogeochemical data.** Zinkl, R.J.; D'Andrea, R.F. Jr.; Shettel, D.L. Jr. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Jan 1981. Contract AC13-76GJ01664. 45p. NTIS, PC A03/MF A01.

Hydrogeochemical and Stream-Sediment Reconnaissance (HSSR) data covering large portions of Alaska, Montana, Wyoming, Colorado, and New Mexico are published by Los Alamos Scientific Laboratory (LASL) and are available on magnetic tape through Oak Ridge National Laboratory. Three separate FORTRAN computer programs are used to read LASL HSSR data. Program LASORT reads single element water and sediment data, program LASLWS reads multielement water data, and program LASLSS reads multielement sediment data. All three programs identify and eliminate questionable data records, subset the data according to sample type, and exclude extraneous data from the output files. Program listings and user documentation are supplied in Appendices A, B, and C.

13432 **(GJBX—53(81)) Aerial radiometric and magnetic survey: North Platte National Topographic Map, Nebraska. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 106p. NTIS, PC E07/MF $7.25.

Includes 34 sheets of 48 reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the North Platte National Topographic Map NK14-7 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

13433 **(GJBX—54(81)) Aerial radiometric and magnetic survey: Pierre National Topographic Map, South Dakota. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 196p. NTIS, PC E09/MF $7.70.

Includes 36 sheets of 48 reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Pierre National Topographic Map NL14-10 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

13434 **(GJBX—55(81)) Aerial radiometric and magnetic survey: McCook National Topographic Map, Kansas/Nebraska. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 202p. NTIS, PC E10/MF $7.85.

Includes 37 sheets of 48 reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the McCook National Topographic Map NK14-10 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

13435 **(GJBX—56(81)) Aerial radiometric and magnetic survey: Limon National Topographic Map, Colorado. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 195p. NTIS, PC E08/MF $7.25.

Includes 34 sheets of 48 reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Limon National Topographic Map NJ13-3 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

13436 **(GJBX—58(81)) Utilizing the geochemical data from the National Uranium Resource Evaluation (NURE) program: an evaluation of the Butte quadrangle, Montana.** Van Eeckhout, E.M. (Montana Coll. of Mineral Science and Technology, Butte (USA)). Dec 1980. Contract AC13-76GJ01664. 59p. NTIS, PC A04/MF A01.

Some 1370 water and 1951 sediment samples were collected from 1994 locations in the Butte quadrangle, Montana, in 1976 and 1977 by the University of Montana for the Los Alamos Scientific Laboratory (LASL). The LASL analyzed the water samples for uranium and the sediment samples for uranium plus 42 additional elements. The data were then released to the Montana College of Mineral Science and Technology (MCMS and T), which was responsible for the evaluation of the uranium data. The data have subsequently been released by the LASL in an open-file report (Broxton, 1980). Statistical evaluations of the data were undertaken for uranium, copper, lead, zinc, manganese, gold, and silver. The uranium evaluations indicated certain areas in the western part of the quadrangle to be favorable for further investigation (particularly along the Rock Creek), as well as anomalous areas just north of Anaconda. The entire Boulder Batholith area had a high uranium background, but there didn't appear to be any particular site in this area that might be worth pursuing. The multielement evaluations confirmed the known base and precious metal provinces within the quadrangle. A methodology for evaluating data tapes from the National Uranium Resource Evaluation (NURE) program was developed and presented throughout this report. This methodology could be developed further to define areas worth exploring for commodities other than uranium.

13437 **(GJBX—59(81)) Aerial gamma ray and magnetic survey: Davenport quadrangle, Iowa and Illinois. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 243p. NTIS, PC E08/MF $3.50.

Includes 8 sheets of 48 reduction microfiche.

The Davenport quadrangle covers approximately 7000 square miles in the heart of the Midwestern Physiographic Province. Overlying thin Paleozoic carbonates and shales are Quaternary glacial and related deposits that largely mask possible bedrock exposures. The Paleozoics are broadly folded and deformed, but this is not evident at the surface. Quaternary loess dominates the surface. A search of available literature revealed no existing uranium claims or known deposits. A total of 88 uranium anomalies were defined according to the standard interpretation procedures. None of these anomalies were considered significant and all relate to cultural features. Concentrations of K, U, and T are relatively low throughout the area. Magnetic data suggest complexities in the underlying Precambrian.

13438 **(GJBX—60(81)) Aerial gamma ray and magnetic survey: La Crosse quadrangle, Iowa, Minnesota, and Wisconsin. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 258p. NTIS, PC E09/MF $3.60.

Includes 8 sheets of 48 reduction microfiche.

The La Crosse quadrangle covers 7060 square miles of Wisconsin, Iowa, and Minnesota. Thin lower Paleozoic and Cretaceous strata are overlain in place by Quaternary glacial deposits and loess. Land use in the area ranges from forested land to intense agricultural activity. A search of available literature revealed no known uranium deposits. Ninety-eight anomalies were detected and briefly described. None are significant and all relate to cultural features. Concentrations of K, U, and T are both uniform and low. Magnetic data suggest complexities in the underlying Precambrian.

13439 **(GJBX—61(81)) Aerial gamma ray and magnetic survey: Waterloo quadrangle, Iowa. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 253p. NTIS, PC E09/MF $3.65.

Includes 8 sheets of 48 reduction microfiche.

The Waterloo quadrangle covers approximately 7048 square miles in the heart of the Midwestern Physiographic Province. Overlying moderately thin Paleozoic material are Quaternary glacial and related deposits that largely mask possible bedrock exposures. A search of available literature revealed no existing uranium claims or known deposits. A total of 86 uranium anomalies were defined according to the standard interpretation procedures. None of these anomalies were considered significant and all relate to cultural features. Concentrations of K, U, and T are relatively low within the area.

13440 **(GJBX—62(81)) Aerial gamma ray and magnetic survey: Des Moines quadrangle, Iowa. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 241p. NTIS, PC E09/MF $3.50.

Includes 8 sheets of 48 reduction microfiche.

The Des Moines quadrangle covers 7030 square miles in the heart of the Midwestern Physiographic Province. Though primarily Quaternary glacially related deposits are exposed, the region contains a thin to moderate thickness of older Phanerozoic sediments atop the shallow Precambrian basement. No uranium deposits are known within the area. Of the 109 anomalies defined by the interpretation processes, none were considered significant, and all appeared to relate to specific features of cultural origin. Concentrations of the measured radioactive elements were found to be relatively low. Magnetic data suggest complexities in the Precambrian basement rather than structures in the Phanerozoic strata.

13441 **(GJBX—63(81)) Aerial gamma ray and magnetic survey: Fairmont quadrangle, Minnesota and Iowa. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 243p. NTIS, PC E08/MF $3.50.

Includes 8 sheets of 48 reduction microfiche.

The Fairmont quadrangle covers 6900 square miles of the northern Midwestern Physiographic Province in northern Iowa and

southern Minnesota. The surface is covered with Quaternary glacial and related deposits. The subglacial surface contains Precambrian basement, and some thin Phanerozoic units. A search of available source material revealed no known uranium deposits. A total of 91 anomalies were detected and briefly discussed in this report. None were considered significant, and all appear to represent cultural features. Quadrangle-wide average concentrations of K, U, and T are all extremely low. Magnetic data appear to illustrate complexities in the underlying Precambrian.

13442 **(GJBX—64(81)) Aerial gamma ray and magnetic survey: Dubuque quadrangle, Iowa, Illinois and Wisconsin. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 265p. NTIS, PC E09/MF $3.65.

Includes 8 sheets of 48 reduction microfiche.

The Dubuque quadrangle covers 7178 square miles of Illinois, Wisconsin, and Iowa. Thin lower Paleozoic strata are overlain in places by Quaternary glacial strata and loess. Land use is principally for agricultural activities. A search of available literature revealed no known uranium deposits. Seventy-nine (79) anomalies were detected and briefly described. None are significant and all relate to cultural features. Concentrations of K, U, and T are both uniform and low in all but the Mississippi River flood plain where concentrations are even lower. Magnetic data suggests both Paleozoic structures and complexities in the underlying Precambrian.

13443 **(GJBX—65(81)) Aerial gamma ray and magnetic survey: Mason City quadrangle, Iowa and Minnesota. Final report.** (EG and G GeoMetrics, Sunnyvale, CA (USA)). Feb 1981. Contract AC13-76GJ01664. 274p. NTIS, PC E09/MF $3.65.

Includes 8 sheets of 48 reduction microfiche.

The Mason City quadrangle covers 6900 miles of the northern Midwestern Physiographic Province in northern Iowa and southern Minnesota. The surface is largely covered by Quaternary glacial and related deposits. The subglacial surface is exposed only in the northeast and is composed of thin Mesozoic and Paleozoic sediments overlying Precambrian basement. A search of available literature revealed no known uranium deposits. A total of 89 uranium anomalies were detected and briefly described in this report. None were considered significant, and all appear to be related to cultural features. Concentrations of K, U, and T are extremely low throughout the quadrangle. Magnetic data appear to illustrate complexities in the underlying Precambrian.

13444 **(GJBX—67(81)) Aerial radiometric and magnetic survey: Minot National Topographic Map, North Dakota. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 220p. NTIS, PC A10/MF A01.

Includes 12 sheets of 48 reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Minot National Topographic Map NM14-10 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of the various geologic units and the corresponding airborne data, is included also.

13445 **(GJBX—68(81)) Aerial radiometric and magnetic survey: Wolf Point National Topographic Map, Montana/ North Dakota. Final report.** (Geodata International, Inc., Dallas, TX (USA)). 1981. Contract AC13-76GJ01664. 212p. NTIS, PC E08/MF $4.10.

Includes 12 sheets of 48 reduction microfiche.

The results of analyses of the airborne gamma radiation and total magnetic field survey flown for the region identified as the Wolf Point National Topographic Map NM13-11 are presented. The airborne data gathered are reduced by ground computer facilities to yield profile plots of the basic uranium, thorium and potassium equivalent gamma radiation intensities, ratios of these intensities, aircraft altitude above the earth's surface, total gamma ray and earth's magnetic field intensity, correlated as a function of geologic units. The distribution of data within each geologic unit, for all surveyed map lines and tie lines, has been calculated and is included. Two sets of profiled data for each line are included, with one set displaying the above-cited data. The second set includes only flight line magnetic field, temperature, pressure, altitude data plus magnetic field data as measured at a base station. A general description of the area, including descriptions of various geologic units and the corresponding airborne data, is included also.

13446 **(K/UR—45) National Uranium Resource Evaluation Program. Data display and analysis programs in the Uranium Resource Evaluation Project Data Processing System.** Begovich, C.L.; Kane, V.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Dec 1980. Contract W-7405-ENG-26. 536p. NTIS, PC A23/MF A01.

The purpose of this manual is to provide a source of documentation for the data display and analysis programs in the Uranium Resource Evaluation (URE) Project Data Processing System (UREP-DPS), which was developed by the Computer Science Division (CSD) personnel. It is intended as neither a comprehensive source of documentation for the individual computer programs nor a detailed user's manual. Rather a compromise between computer processing and program usage is attempted. This manual should provide adequate computer program documentation if the actual computer code is used as a basis. Also, this material should enable the user to assess the general capability of the UREP-DPS. Detailed reading of the material in each chapter will provide specific program information such as various program options. The novice user of the UREP-DPS should consult the URE Project report Hydrogeochemical and Stream Sediment Reconnaissance Basic Data Reports Computer Program Request Manual (URE Project, January 1980).

0504 Feed Processing

REFER ALSO TO CITATION(S) 13485

0505 Enrichment

13447 **Method and apparatus for rapid adjustment of process gas inventory in gaseous diffusion cascades.** (to Department of Energy, Washington, DC (USA)). British Patent 1,572,267/A/. 30 Jul 1980. 15p.

A method is specified for the operation of a gaseous diffusion cascade wherein electrically driven compressors circulate a process gas through a plurality of serially connected gaseous diffusion stages to establish first and second countercurrently flowing cascade streams of process gas, one of the streams being at a relatively low pressure and enriched in a component of the process gas and the other being at a higher pressure and depleted in the same, and wherein automatic control systems maintain the stage process gas pressures by positioning process gas flow control valve openings at values which are functions of the difference between reference-signal inputs to the systems, and signal inputs proportional to the process gas pressures in the gaseous diffusion stages associated with the systems, the cascade process gas inventory being altered, while the cascade is operating, by simultaneously directing into separate process-gas freezing zones a plurality of substreams derived from one of the first and second streams at different points along the lengths thereof to solidify approximately equal weights of process gas in the zone while reducing the reference-signal inputs to maintain the positions of the control valves substantially unchanged despite the removal of process gas inventory via the substreams.

0506 By-products

13448 Recovery and use of fission product noble metals. Jensen, G.A.; Rohrmann, C.A.; Perrigo, L.D. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 335-336(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 13522, 14415

13449 (NUREG/CR—1446) Preparation of working reference materials: uranium dioxide. Technical report. Hand, R.L.; Spraktes, F.W.; Baldwin, J.M. (Allied Chemical Corp., Idaho Falls, ID (USA)). May 1980. 53p. NTIS, PC A04/MF A01.

Reliable working reference materials (WRMs) are essential to a meaningful measurement assurance program. This report describes recommended starting materials and procedures for the preparation of uranium dioxide WRMs used in the testing of analytical personnel and in calibrating and maintaining measurement control surveillance of methods of chemical analysis for uranium content and isotopic distribution measurements. Uranium dioxide WRMs can be synthesized from characterized starting materials or prepared from typical plant materials by thorough characterization relative to certified reference materials (CRMs). Detailed statistical treatments are included to provide a reliability measure of prepared WRMs for application to nuclear materials accountability and safeguards.

13450 Conceptual design of a remote gel-sphere-pac fuel fabrication plant. Burke, D.F.; Holaday, V.D.; Petchul, J.J. (Babcock and Wilcox Co., Lynchburg, VA). *Transactions of the American Nuclear Society ;* **34**: 858-862(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13451 Packed particle nuclear fuel fabrication plant reliability study. Colbert, E.K.; Smith, L.A.; Storton, J.M. (Babcock and Wilcox Co., Lynchburg, VA). *Transactions of the American Nuclear Society ;* **34**: 862-863(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

0508 Spent Fuels Reprocessing

13452 (DP-MS—80-86) Desk-top microcomputer for lab-scale process control. Overman, R.F.; Byrd, J.S.; Goosey, M.H.; Sand, R.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 25p. (CONF-810329—2). NTIS, PC A02/MF A01.

From Pittsburgh conference of analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (9 Mar 1981).

A desk-top microcomputer was programmed to acquire the data from various process control sensors installed in a laboratory scale liquid-liquid extraction, pulse column facility. The parameters monitored included valve positions, gamma spectra, alpha radioactivity, temperature, pH, density, and flow rates. The program for the microcomputer is written in BASIC and requires about 31000 8-bit bytes of memory. All data is stored on floppy discs, and can be displayed or printed. Unexpected data values are brought to the process operator's attention via CRT display or print-out. The general organization of the program and a few subroutines unique to polling instruments are explained. Some of the data acquisition devices were designed and built at the Savannah River Laboratory. These include a pulse height analyzer, a data multiplexer, and a data acquisition instrument. A general description of the electronics design of these instruments is also given with emphasis placed on data formatting and bus addressing.

13453 (DP-MS—81-3) Ventilation systems for a spent LWR fuel recycle complex. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 27p. (CONF-810101—6). NTIS, PC A03/MF A01.

From American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) meeting; Chicago, IL, USA (25 Jan 1981).

A conceptual design study has been made of a facility to recycle spent Light Water Reactor fuel. This study was based on co-processing of plutonium and uranium where plutonium is never available as a separate material. The design of the fuel reprocessing facilities is based on remote operation and remote maintenance. The experience of many years of safe and dependable operation of government fuel processing facilities at Savannah River and Hanford was used in the design. A requirement of the study was that the facilities be licensable under Title 10 and Title 40 of the Code of Federal Regulations.

13454 Nonaqueous reprocessing method for thorium-based fuels. Bates, J.K.; Jardine, L.J.; Krumpelt, M. (Argonne National Lab., IL). *ACS (American Chemical Society) Symposium Series ;* No. 117, 207-217(1980).

A conceptual flow sheet for the pyrometallurgical reprocessing of thorium-based fuels has been presented which meets current concerns abpout nonproliferation and waste control. Preliminary results indicate the desired process streams, uranium/thorium and plutonium/thorium, can be obtained using actinide solubility differences in cadmium-magnesium alloys and that salt waste can be minimized by electrolyzing CaO produced during the reduction process and recycling the calcium. However, further optimization of conditions controlling the reduction rate must be achieved before the process can be used for oxide fuels.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 13509

13455 (DOE/PE/70278—T7) Away from reactor (AFR) storage facilities. Feuerwerger, P. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 17p. NTIS, PC A02/MF A01.

The author believes that on-site storage, rather than AFRs, should be supported and encouraged. However, if AFRs are mandated, they should be owned and operated cooperatively among the utilities, if financing and PUC problems can be overcome. If Government ownership and operation is mandated, the AFRs should be run by an independent agency or office with a revolving fund dedicated to specific tasks.

13456 (PB—80-180656) Transportation issues regarding low-level nuclear waste. Milstein, R.; Vogt, D.K. (Teknekron, Inc., McLean, VA (USA)). Jun 1979. 34p. NTIS, PC A03/MF A01.

The purpose of the report was to review the status of low-level waste (LLW) management and to identify associated transportation issues and problems for further analysis. The report presents projections of annual amounts of government and commercial (both fuel cycle and non-fuel cycle) LLW. It then describes the present status of waste disposal at the three existing burial grounds: Barnwell, SC, Beatty, NV, and Hanford, WA. Using a waste allocation model developed by Teknekron, the authors assess the transportation effects of regional constraints on LLW management through three scenarios. Case A assumes the status quo, with a restriction on receipt of wastes at Barnwell continuing indefinitely. Case B assumes a new site in the Northeast opens in 1985. Case C assumes that administrative restriction on Barnwell is lifted. The authors point out that the other scenarios are possible.

13457 (PNL-SA—9005) Thermohydraulic analysis of a spent fuel assembly contained within a canister. McCann, R.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Oct 1980. Contract AC06-76RL01830. 9p. (CONF-801102—35). NTIS, PC A02/MF A01.

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

A finite difference computer code has been developed to simulate the three-dimensional performance of a spent fuel assembly contained within a canister. The code accounts for the coupled heat transfer modes of conduction, convection, and radiation and permits spatially varying boundary conditions, thermophysical properties, and power generation rates. Two dozen different cases have been examined. The cases encompass variations in fuel assembly and canister configurations, power generation rates, filler materials, and gases. Results show maximum and various local temperatures and heat fluxes illustrating the changing importance of the three heat transfer modes. Finally, the need for comparison with experimental data is emphasized as an aid in code verification notwithstanding the fact that the limited data available indicate excellent agreement.

13458 **(PNL-SA—9247) Two factors important to the criticality potential of spent fuel in geologic repositories.** Gore, B.F.; Jenquin, U.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 29p. (CONF-810217—10). NTIS, PC A02/MF A01.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

Two factors important to the criticality potential of spent fuel in geologic repositories are: the residual fissile content of the fuel, and the extent to which geochemical processes might somehow separate and accumulate plutonium from other spent fuel materials. This paper presents the results of two calculational surveys defining conditions required for criticality. In the first, homogeneous spherical mixtures of spent fuel actinide oxides and water with water reflection are analyzed. Graphs of minimum critical mass vs duration of in-reactor exposure are presented. Parametric variations from a base case are explored, including the effects of initial enrichment, post exposure radioactive decay and addition of rock materials to the mixture. In the second study, homogeneous spherical mixtures devoid of water, containing plutonium and a neutronically optimized rock material, with a thick rock neutron reflector are analyzed. Graphs of Pu critical mass are presented as a function of concentration over the range from 2 to 100 g Pu/l. Parametric variations from a base case are explored, including effects of rock composition, ^{240}Pu content and uranium contamination of the plutonium.

13459 **(UCRL—53064) Spent fuel test-climax: technical measurements interim report, FY 1980.** Carlson, R.C.; Patrick, W.C.; Wilder, D.G.; Brough, W.G.; Montan, D.N.; Harben, P.E.; Ballou, L.B.; Heard, H.C. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1 Dec 1980. Contract W-7405-ENG-48. 110p. NTIS, PC A06/MF A01.

The Spent Fuel Test--Climax (SFT-C), a test of the retrievable geologic storage of spent fuel assemblies from an operating commercial power reactor, is under way at the Nevada Test Site of the US Department of Energy. Although the main thrust of the project is a demonstration of the feasibility of packaging, handling, storing, and retrieving the highly radioactive fuel assemblies, over 800 data channels have been installed to monitor the response of the rock to the heat and radiation produced by the fuel assemblies and to distinguish in that response the effect due to heat alone. Temperatures in the test array are tracking well with thermal modeling calculations performed before the test was started. The fuel assemblies have been in place since May 1980. The canisters have passed through skin temperature maxima of about 145°C and are currently declining in temperature. Evidence is emerging that the thermomechanical response of the rock surrounding the SFT-C is strongly affected by fractures and other discontinuities inthe rock. Most of the effort to date has been in project construction, design, and installation of the instrumentation. Although the data are available in raw form for verification purposes, the data are not as yet in a suitable form for detailed analyses. Work continues on the data management aspects of the project and in continued monitoring of the test.

13460 **Spent LWR fuel encapsulation and dry storage demonstration.** Bahorich, R.J.; Durrill, D.C.; Cross, T.E.; Unterzuber, R. (W-AES, Pittsburgh, PA). *Transactions of the American Nuclear Society ;* **34**: 834-835(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13461 **Equipment designs for the spent LWR fuel dry storage demonstration.** Steffen, R.J.; Kurasch, D.H.; Hardin, R.T.; Schmitten, P.F. (W-AES, Pittsburgh, PA). *Transactions of the American Nuclear Society ;* **34**: 835-837(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

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13462 **(ANL—80-76) Fuel cycle programs. Quarterly progress report, January-March 1980.** Steindler, M.J.; Bates, J.K.; Brock, R.E. (Argonne National Lab., IL (USA)). Feb 1981. Contract W-31-109-ENG-38. 75p. NTIS, PC A04/MF A01.

Studies were continued on the encapsulation of radioactive waste in metal. The possibility of interactions between simulated waste glass and lead in air and argon atmospheres was explored. No reactions were observed at 350 and 500°C; however, a potential reaction was indicated at 685°C in air. A comparative economic analysis of four waste solidification processes subcontracted to TERA Corporation was completed. Within the uncertainties of the cost estimates, the cost of the four processes (two yielding metal-matrix encapsulated waste forms and two yielding glass monoliths) was about the same, with the major cost component being the cost of the building structures. Results of ten drop-weight brittle-fracture tests with Pyrex cylinders indicated that, for the same impact energy density, threefold variations in either drop velocity or cylinder size had no significant effect on the principal parameters of the test model. The kinetics of fracture is being studied by means of high-speed motion pictures. Tests indicated that evaporation losses of solutions collected during infiltration experiments were too small to significantly affect the experimental results. Studies were initiated to determine the cause of the discrepancy between the experimental Cs^+ velocity in kaolinite columns during 0.1M $NaHCO_3$ flow and the velocity calculated from the partitioning coefficient. A mathematical model was developed in an effort to explain why the experimentally determined isotherm for IO_3 sorption on Fe_2O_3 differed from the Langmuir isotherm. Developmental studies of the neutron activation method and the use of tracers for determining very low leach rates were continued. Other studies showed that hydrothermal leaching of glass produced a large increase in surface area.

13463 **Introduction and historical perspective.** Heckman, R.A. (Lawrence Livermore Lab., CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-27**: No. 4, 1258-1264(Aug 1980).

Consideration is given to the sources of waste from the nuclear fuel cycle; defining the temporal problem of nuclear waste disposal relative to other natural hazards; looking at current waste inventories; studying the history of nuclear waste management; and, making some projections of future inventories.

13464 **(DP—1570) Solid waste combustion for alpha waste incineration.** Orloff, D.I. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Feb 1981. Contract AC09-76SR00001. 66p. NTIS, PC A04/MF A01.

Radioactive waste incinerator development at the Savannah River Laboratory has been augmented by fundamental combustion studies at the University of South Carolina. The objective was to measure and model pyrolysis and combustion rates of typical Savannah River Plant waste materials as a function of incinerator operating conditions. The analytical models developed in this work have been incorporated into a waste burning transient code. The code predicts maximum air requirement and heat energy release as

a function of waste type, package size, combustion chamber size, and temperature. Historically, relationships have been determined by direct experiments that did not allow an engineering basis for predicting combustion rates in untested incinerators. The computed combustion rates and burning times agree with measured values in the Savannah River Laboratory pilot (1 lb/hr) and full-scale (12 lb/hr) alpha incinerators for a wide variety of typical waste materials.

13465 **(DP-MS—80-77) Alternatives for long-term management of transuranic waste at the Savannah River Plant.** Towler, O.A. Jr.; Molen, G.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 16p. (CONF-810217—11). NTIS, PC A02/MF A01.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

The six alternatives proposed consider the effects of making no decision (Alternative 1), delaying a decision for up to 100 years (Alternatives 2 and 3), or taking significant action (Alternatives 4, 5, or 6). Alternative 4 exhibits intermediate cost and risk values, and indicates good agreement with ideal disposal characteristics. Alternative 6, which is comparable to Alternative 4 in risk and disposal characteristics, would require a large single outlay of capital funds, whereas funds for Alternative 4 could be staged. The cases described, excluding the no-action case, represent the better alternatives of the 34 that have been studied. Their costs range from 80 to 270 million dollars, while the sum of the population risk and worker dose ranges from 95 to 13,800 man-rem. The naturally occurring dose from cosmic rays and terrestrial activity to the same population over the same period is many times larger.

13466 **(DP-MS—81-4) Small-scale integrated demonstration of high-level radioactive waste processing and vitrification using actual SRP waste.** Woolsey, G.B.; Baumgarten, P.K.; Eibling, R.E.; Ferguson, R.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 14p. (CONF-810217—9). NTIS, PC A02/MF A01.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

A small-scale pilot plant for chemical processing and vitrification of actual high-level waste has been constructed at the Savannah River Laboratory (SRL). This fully integrated facility has been constructed in six shielded cells and has eight major unit operations. Equipment performance and processing characteristics of the unit operations are reported.

13467 **(EGG—2076) Current practice of incineration of low-level institutional radioactive waste.** Cooley, L.R.; McCampbell, M.R.; Thompson, J.D. (Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office). Feb 1981. Contract AC07-761D01570. 45p. NTIS, PC A03/MF A01.

During 1972, 142 medical and academic institutions were surveyed to assess the current practice of incineration of low-level radioactive waste. This was one activity carried out by the University of Maryland as part of a contract with EG and G Idaho, Inc., to site a radioactive waste incineration system. Of those surveyed, 46 (approximately 32%) were presently incinerating some type of radioactive waste. All were using controlled-air, multistage incinerators. Incinerators were most often used to burn animal carcasses and other biological wastes (96%). The average size unit had a capacity of 113 kg/h. Disposal of liquid scintillation vials posed special problems; eight institutions incinerated full scintillation vials and five incinerated scintillation fluids in bulk form. Most institutions (87%) used the incinerator to dispose of other wastes in addition to radioactive wastes. About half (20) of the institutions incinerating radioactive wastes reported shortcomings in their incineration process; those most often mentioned were: problems with liquid scintillation wastes, ash removal, melting glass, and visible smoke. Frequently cited reasons for incinerating wastes were: less expensive than shipping for commercial shallow land burial, volume reduction, convenience, and closure of existing disposal sites.

13468 **Nuclear waste management: the need for immediate legislative reform.** Ostrander, J.L.; Masters, L.S. (Univ. of Notre Dame, IN). *Journal of Legislation ;* 7: 78-92(Feb 1980).

The process of nuclear energy production is reviewed, and the prospects for technological solutions to the existing nuclear waste disposal problem are examined. The existing regulatory framework and its deficiencies in dealing with nuclear waste are discussed. Regardless of future decisions regarding the use of nuclear power, an environmentally wise and politically acceptable nuclear waste management program must be developed and implemented immediately. (101 references)

13469 **(HEDL-SA—2239-FP) Radioactive Acid Digestion Test Unit (RADTU), 1980.** Allen, C.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 30 Sep 1980. Contract AC14-76FF02170. 44p. (CONF-8010163—1). NTIS, PC A03/MF A01.

From International workshop on acid digestion; Richland, WA, USA (7 Oct 1980).

The Radioactive Acid Digestion Test Unit (RADTU) was constructed at the Hanford Site, Richland, WA to demonstrate application of the acid digestion process for treating combustible transuranic wastes and scrap materials. Using its original tray digester vessel, RADTU recently completed a six-month campaign of processing potentially contaminated non-glovebox wastes from a Hanford plutonium facility. During the campaign, 2100 kg of largely cellulosic wastes were processed at an average sustained processing rate of 3 kg/h (limited by the acid-waste contact and the water boiloff rate from the acid feeds). On-line operating efficiency was nearly 50%, averaged over 12 hours/day, for five days/week. After shutdown, a new annular high-rate digester was installed for testing that demonstrated a sustained capacity of 8 kg/h to 10 kg/h with greatly improved contact between the digestion acid and the waste. The new unit began processing low-level waste from Hanford's z-Plant during June 1980. Plutonium levels in the waste processed will be increased gradually as operating experience has been gained. Processing recoverable scrap is expected to begin in the last quarter of CY 1980.

13470 **(LA—8612-PR) Research and development related to the Nevada nuclear waste storage investigations. Progress report, July 1-September 30, 1980.** Wolfsberg, K.; Erdal, B.R.; Crowe, B.M. (comps.). (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 26p. NTIS, PC A03/MF A01.

Sorption of americium and plutonium was measured in a controlled, oxygen-free atmosphere and in air on a series of tuff samples. Sorption of plutonium was greater in the controlled atmosphere than in air. Sorption of both elements is higher on zeolitized tuff than devitrified tuff. Sorption of strontium, cesium, barium, cerium, and europium is being measured on tuff samples of mineralogies not previously studied, and samples from the USW-G1 drill hole have been selected for study. Work on the dependence of the sorption ratio on element concentration (barium and europium) and on solution-to-solid ratios is reported. Progress on controlling Eh and making Eh measurements is presented. Some tuff-water systems exhibit reduced or negative Eh values under oxygen-free conditions. Development of a method for encasing cores for flow studies is discussed. Field geologic mapping is being conducted in the Lunar Crater volcanic field of central Nevada. Mineralogy-petrology studies are being conducted on core samples from the USW-G1 exploration hole in Yucca Mountain. Zeolite heating tests of core samples from UE25a-1 show density, volume, and weight changes that correlate with alteration of mineral assemblages. Hydrogen-deuterium ratios in water evolved from a clinoptilolite specimen from Yucca Mountain have been measured. Jacket seals leaked during the first attempt at high temperature exposure in the hydrothermal soak tests. Revised seals using temperature-cured epoxy are being developed. Data from strength tests for various types of tuff conducted at ambient pressure and 400°C for 16 h are presented. A densely welded specimen showed a 40% reduction in strength.

13471 **(LBL—11204) Proceedings of workshop on thermomechanical-hydrochemical modeling for a hardrock waste repository.** Schwarz, W.J. (ed.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1980. Contract W-7405-ENG-48. 141p. (CONF-800751—; ONWI—164). NTIS, PC A07/MF A01.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

Individual papers were entered into the data base.

13472 (LBL—11204, pp 10-15) **Laboratory investigations.** Handin, J. (Texas A and M Univ., College Station). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

Our task is to design mined-repository systems that will adequately secure high-level nuclear waste for at least 10,000 yr and that will be mechanically stable for 50 to 100-yr periods of retrievability during which mistakes could be corrected and a valuable source of energy could be reclaimed, should national policy on the reprocessing of spent fuel ever change. The only credible path for the escape of radionuclides from the repository to the biosphere is through ground-water, and in hard rock, bulk permeability is largely governed by natural and artificial fracture systems. Catastrophic failure of an excavation in hard rock is likely to occur at the weakest links - the discontinuities in the rock mass that is perturbed first by mining and then by radiogenic heating. The laboratory can contribute precise measurements of the pertinent thermomechanical, hydrological and chemical properties and improve our understanding of the fundamental processes through careful experiments under well controlled conditions that simulate the prototype environment. Thus laboratory investigations are necessary, but they are not sufficient, for conventional sample sizes are small relative to natural defects like joints - i.e., the rock mass is not a continuum - and test durations are short compared to those that predictive modeling must take into account. Laboratory investigators can contribute substantially more useful data if they are provided facilities for testing large specimens(say one cubic meter) and for creep testing of all candidate host rocks. Even so, extrapolations of laboratory data to the field in neither space nor time are valid without the firm theoretical foundations yet to be built. Meanwhile in-situ measurements of structure-sensitive physical properties and access to direct observations of rock-mass character will be absolutely necessary.

13473 (LBL—11204, pp 16-21) **Review of the state-of-the-art of thermomechanical-hydrochemical modeling of a hardrock waste repository.** Tsang, C.F. (Lawrence Berkeley Lab., CA). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

The present paper attempts to answer three questions concerning the state-of-the-art of numerical modeling for nuclear waste repositories: (1) what are the major issues involved; (2) where are we now; (3) what further research we need to do. The arguments presented are somewhat subjective, but will, we hope, form a basis for further discussions. Much work remains to be done in model validation (especially for fractured rock masses); model application to understand relevant processes, and the study of the couplings among processes. With a concerted effort, we would hope in the near future to have a good understanding of all the processes involved in order to enable us to make a reasonably confident long-term prediction of the behavior of a hardrock waste repository.

13474 (LBL—11204, pp 22-33) **Synopsis of in situ testing for mined geologic disposal of radioactive wastes.** Gnirk, P.F. (RE/SPEC Inc., Rapid City, SD). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

The concept of mined geologic disposal of radioactive wastes was proposed about 25 years ago. Until the mid-1970's, research and development activities were directed essentially to the evaluation of the disposal concept fot salt formations. During the past 5 years, the waste disposal technology programs in the USA and other countries have been expanded substantially in effort and scope for evaluation of a broader range of geologic media beyond salt, including basalt, granite, shale, and tuff. From the outset, in situ testing has been an integral part of these programs, and has included activities concerned with rock mass characterization, the phenomenological response of rock to waste or simulated waste emplacement, model development and verification, and repository design. This paper provides a synopsis of in situ tests that have been or are being performed in geologic media in support of the waste disposal programs in the USA, the United Kingdom, Sweden, and the Federal Republic of Germany.

13475 (LBL—11204, pp 34-36) **Key issues.** Cook, N.G.W. (Univ. of California, Berkeley). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

Successful modeling of the thermo-mechanical and hydrochemical behavior of radioactive waste repositories in hard rock is possible in principle. Because such predictions lie outside the realm of experience, their adequacy depends entirely upon a thorough understanding of three fundamental questions: an understanding of the chemical and physical processess that determine the behavior of rock and all its complexities; accurate and realistic numerical models of the geologic media within which a repository may be built; and sufficient in-situ data covering the entire geologic region affected by, or effecting the behavior of a repository. At present sufficient is known to be able to identify most of those areas which require further attention. These areas extend all the way from a complete understanding of the chemical and physical processes determining the behavior of rock through to the exploration mapping and testing that must be done during the development of any potential repository. Many of the techniques, laboratory equipment, field instrumentation, and numerical methods needed to accomplish this do not exist at present. Therefore it is necessary to accept that a major investment in scientific research is required to generate this information over the next few years. The spectrum of scientific and engineering activities is wide extending from laboratory measurements through the development of numerical models to the measurement of data in-situ, but there is every prospect that sufficient can be done to resolve these key issues. However, to do so requires overt recognition of the many gaps which exist in our knowledge and abilities today, and of the need to bridge these gaps and of the significant costs involved in doing so.

13476 (LBL—11204, pp 45-55) **Thermomechanical and macropermeability experiments in the Stripa granite: status report.** Nelson, P.; Wilson, C. (Lawrence Berkeley Lab., CA). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

The first portion of this paper reviews the status of thermomechanical experiments just completed in the time scale and full scale drifts. The second part discusses the macropermeability experiment underway in the ventilation drift. The initial results of the macropermeability experiment show that the ventilation and pressure measurement techniques applied at Stripa can be reliably employed to generate reproduceable results in the measurement of low hydraulic conductivities in large volumes of fractured rock. LBL's tests have shown, however, that the accuracy of these techniques is quite sensitive to local geological and hydrologic conditions, and this use should be carefully evaluated for each application.

13477 (LBL—11204, pp 56-61) **Mining technology development for hard rock excavation.** Hustrulid, W. (Colorado School of Mines, Golden); Cudnick, R.; Trent, R.; Holmberg, R. Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

A research facility has been established in the granitic gneiss of the CSM Experimental Mine at Idaho Springs, Colorado, for the purpose of evaluating/developing mining, geologic and geotechnical procedures appropriate for use in establishing nuclear waste repositories in hard rock. An experimental room has been excavated

using careful blasting procedures. The extent and magnitude of blast damage is being evaluated. Structural geology is being mapped to assess continuity.

13478 (LBL—11204, pp 62-69) **Thermal/mechanical modeling for a tuff repository.** Tyler, L.D. (Sandia National Labs., Albuquerque, NM). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

An upper limit has been established for future analysis of tuff. This limit is 100 kW/acre at a 20% extraction ratio. Because of the nature of tuff, a constitutive model was developed which uses the field joint data to provide the thermal mechanical analysis of the repository. As studies progress, data needs and basic assumptions of the phenomena modeled will be evaluated. Uncertainty in available data may require sensitivity analyses to determine if the uncertainty is critical, followed by or in conjunction with laboratory and in-situ experiments designed to acquire the needed data. Additional modeling may be required after completing laboratory and in-situ experiments.

13479 (LBL—11204, pp 89-94) **Current status of the hydrogeology for the WIPP.** Barr, G.E.; Gonzalez, D.D. (Sandia National Labs., Albuquerque, NM). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

The current efforts to define the hydraulic system at the proposed WIPP site are described. These efforts are directed toward further refinement of the field data and conducting specific tests to determine the isotropy of the media and the appropriateness of their representation as porous or as fractured systems.

13480 (LBL—11204, pp 95-103) **In situ investigations at Avery Island.** Van Sambeek, L.L. (RE/SPEC Inc., Rapid City, SD). Nov 1980.

From Workshop on thermomechanical-hydrochemical modeling for hardrock waste repository; Bereley, CA, USA (29 Jul 1980).

Descriptions and representative data are given for the in situ investigations being performed in the Avery Island Mine. Sufficient detail is presented such that investigators can judge whether any of the studies being performed would be valuable for their numerical modeling exercises. The basic investigations being performed include heater tests, brine migration experiments, and flatjack tests. The heater tests consist of the emplacement of single simulated waste canisters with different power levels. The bulk thermal and mechanical response is measured of the salt surrounding the emplacement. The brine migration studies involve the measurement of moisture inflow into heated boreholes. The flatjack studies are an investigation of the deformation of the borehole when subjected to controlled boundary conditions of stress and temperature.

13481 (NUREG/CR—0570-V-1) **Technology, safety and costs of decommissioning a reference low-level waste burial ground. Volume 1. Main report, technical report.** Murphy, E.S.; Holter, G.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 445p. NTIS, PC A19/MF A01.

Technology, safety and cost information is presented for the conceptual decommissioning of a reference low-level waste burial grounds, both on a dry and wet site. Two basic approaches to decommissioning, stabilization followed by at least 200 years of surveillance and disinterment, were studied to obtain comparisons between costs and occupational radiation doses, potential dose to the public and other safety impacts.

13482 (NUREG/CR—0570-V-2) **Technology, safety and costs of decommissioning a reference low-level waste burial ground. Volume 2. Appendices. Technical report.** Murphy, E.S.; Holter, G.M. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 267p. NTIS, PC A12/MF A01.

Contents: Reference site details; Waste inventory details; Radiation dose methodology; Environmental surveillance and records maintenance details; Payments needed to finance decommissioning; Site/waste stabilization decommissioning activity details; Waste relocation decommissioning activity details; Cost assessment details; Radiological safety details.

13483 (NUREG/CR—1397) **Risk methodology for geologic disposal of radioactive waste: small sample sensitivity analysis techniques for computer models, with an application to risk assessment.** Iman, R.L.; Conover, W.J.; Campbell, J.E. (Sandia Labs., Albuquerque, NM (USA)). May 1980. 133p. NTIS, PC A07/MF A01.

As modeling efforts expand to a broader spectrum of areas the amount of computer time required to exercise the corresponding computer codes has become quite costly. This costly process can be directly tied to the complexity of the modeling, which makes the relationships among the input variables not mathematically tractable. In this setting it is desired to perform sensitivity studies of the input-output relationships. A variety of situations require that decisions and judgments be made in the face of uncertainty, such as lack of knowledge about probability distributions associated with input variables, different hypothesized future conditions, or different strategies associated with a decision making process. In this paper a generalization of Latin hypercube sampling is given that allows these areas to be investigated without making additional computer runs.

13484 (ORNL/TM—7597) **Expected environments for a defense high-level waste repository in salt.** Rickertsen, L.D.; Claiborne, H.C. (Science Applications, Inc., Oak Ridge, TN (USA); Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 47p. NTIS, PC A03/MF A01.

Expected environments for a defense high-level waste (DHLW) repository in salt have been predicted analogously to previous analyses for spent fuel (SF) and reprocessed commercial high-level wastes (CHLW). Environments predicted include near-field and far-field temperatures, fluid, pressure, and nuclear radiation fields. Some sensitivity studies have also been performed. The main results of the calculations reported here include the following: (1) rock temperatures, canister wall temperatures, and waste temperatures do not exceed 86, 94, and 101°C, respectively; (2) the maximum brine inflow rate to an emplacement hole is 0.015 L/yr, occurring in the first 30 yr after emplacement. The total accumulation of brine migrating to the emplacement hole after 1000 yr is < 0.5 L; (3) gas pressures encountered by the waste package do not exceed 0.36 MPa prior to mine closure. After this time, it is conceivable that stress on the canister could approach the lithostatic rock stresses; (4) maximum dose rates in the salt are < 1400 rads/h.

13485 (PB—80-178619) **Computer analysis of seepage and groundwater response beneath tailings impoundments.** Davis, L.A. (Waste and Land Systems, Inc., Fort Collins, CO (USA)). 8 Apr 1980. 96p. NTIS, PC A05/MF A01.

Research was undertaken to determine the possibility of using a computer model to estimate the seepage rates from tailings impoundments. The tailings must be disposed of in an environmentally acceptable manner. Techniques developed by others were modified and combined with an existing computer model for saturated groundwater flow. This computer program is capable of simulating seepage from the impoundment, groundwater response beneath the impoundment, and the effects of previous seepage on the calculation of the subsequent seepage rate. The model, is general, allowing for spatial variations of hydraulic properties, complex impoundment geometry, and arbitrary initial conditions. The model analyzed a few simple problems with encouraging results and acceptable data requirements.

13486 (PNL-SA—7822) **Glass: an available material for the immobilization of nuclear waste.** Mendel, J.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1979. Contract AC06-76RL01830. 21p. (CONF-791103—113). NTIS, PC A02/MF A01.

From American Nuclear Society meeting; San Francisco, CA, USA (12 Nov 1979).

This paper describes the properties of waste glass as it can be produced today, and shows how the properties of waste glass can fit into a multibarrier nuclear waste management system. The

composition of the wastes that are to be immobilized and the design of processing equipment are also discussed.

13487 **(PNL-SA—8712) Standard leach tests for nuclear waste materials.** Strachan, D.M.; Barnes, B.O.; Turcotte, R.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 9p. (CONF-801124—46). NTIS, PC A02/MF A01.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Five leach tests were conducted to study time-dependent leaching of waste forms (glass). The first four tests include temperature as a variable and the use of three standard leachants. Three of the tests are static and two are dynamic (flow). This paper discusses the waste-form leach tests and presents some representative data. 4 figures. (DLC)

13488 **(PNL-SA—8755) Management of intermediate-level radioactive wastes in the United States.** Aaberg, R.L.; Lakey, L.T.; Greenborg, J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1980. Contract AC06-76RL01830. 21p. (CONF-800802—25). NTIS, PC A02/MF A01.

From 89. annual meeting of the American Institute of Chemical Engineers; Portland, OR, USA (17 Aug 1980).

While used extensively, the term intermediate-level waste is not a clearly defined waste category. Assuming the ILW includes all radioactive wastes requiring shielding but not ordinarily included in a high-level waste canister, its major sources include power plant operations, spent fuel storage, and spent fuel reprocessing. While the volume is $\sim 10^2$ greater than that of high-level waste, ILW contains only $\sim$ 1% of the radioactivity. Power plant waste, constituting $\sim$ 87% of the waste volume, is generally nontransuranic waste. The other approximately 13% from fuel reprocessing is generally transuranic. Intermediate-level wastes fall into the general categories of highly radioactive hardware, failed equipment, HEPA filters, wet wastes, and noncombustible solids. Within each category, however, the waste characteristics can vary widely, necessitating different treatments. The wet wastes, primarily power plant resins and sludges, contribute the largest volume; fuel hulls and core hardware represent the greatest activity. Numerous treatments for intermediate-level wastes are available and have been used successfully. Packaging and transportation systems are also available. Intermediate-level wastes from power plants are disposed of by shallow-land burial. However, the alpha-bearing wastes are being stored pending eventual disposal to a geologic repository or by other means, e.g., intermediate-depth burial, sea disposal. Problem areas associated with intermediate-level wastes include: disposal criteria need to be established; fixation of organic ion exchange resins from power plant operation needs improvement; and reprocessing of LWR fuels will produce ILW considerably different from power plant ILW and requiring different treatment.

13489 **(PNL-SA—8762) Direct liquid-feeding of defense wastes to a continuous melter.** Brouns, R.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 24p. (CONF-801107—67). NTIS, PC A02/MF A01.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

Full-scale studies involving the slurry-feeding of a simulated high-level defense waste to an electric glass-melter have been successfully completed. Steady-state operation was achieved, giving encouraging results on process capacities. Reducing agents added to the feed helped to control glass-foaming during melting. A reduction in the formation of insoluble precipitates in the melter was noted. Volatility of the radionuclide substitutes in the feed was found to be low, except for Cs. Further chemical volatility studies are required due to the unexplainably high volatility measured for the Cs. Particulate entrainment in the offgas during melter operation was also determined to be low.

13490 **(PNL-SA—8829) Application of asphalt emulsion seals to uranium mill tailings.** Hartley, J.N.; Koehmstedt, P.L.; Esterl, D.J.; Freeman, H.D.; Clark, R.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1980. Contract AC06-76RL01830. 19p. (CONF-801155—4). NTIS, PC A02/MF A01.

From 3. annual symposium on uranium mill tailings management; Ft Collins, CO, USA (24 Nov 1980).

Studies of asphalt emulsion sealants have demonstrated that the sealants are effective in containing radon and other potentially hazardous material within uranium tailings. The laboratory and field studies have further demonstrated that radon exhalation from uranium tailings piles can be reduced by greater than 99% to less than background levels. Field tests at the tailings pile in Grand Junction, Colorado confirmed that an 8-cm admix seal containing 22 wt % asphalt could be effectively applied with a cold-mix paver. Other techniques were successfully tested, including a soil stabilizer and a hot, rubberized asphalt seal that was applied with a distributor truck. After the seals were applied and compacted, overburden was applied over the seal to protect the seal from ultraviolet degradation. 14 figures.

13491 **(PNL-SA—8872) Application of controlled release technology to uranium mill tailings stabilization.** Burton, F.G.; Cataldo, D.A.; Cline, J.F.; Skiens, W.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 18p. (CONF-810217—8). NTIS, PC A02/MF A01.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

A trifluralin (herbicide) releasing device was developed with a theoretical effective lifetime in excess of 100 years. When placed in a layer in soil, the PCD system will prevent root penetration through that layer without harming the overlying vegetation. Equilibrium concentrations of trifluralin in soil can be adjusted (along with the theoretical life of the device) to suit specific needs. The present system was designed specifically to protect the asphalt layer or clay/aggregate barriers on uranium mill tailings piles; PCD devices composed of pellets could also be implanted over burial sites for radioactive and/or toxic materials, preventing translocation of those materials to plant shoots, and thence into the biosphere.

13492 **(PNL-SA—8931) Effects of cracks on glass-leaching.** Perez, J.M. Jr.; Westsik, J.H. Jr. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 19p. (CONF-801206—10). NTIS, PC A02/MF A01.

From ORNL conference on the leachability of radioactive solids; Gatinburg, TN, USA (9 Dec 1980).

The effects of cracks on glass leaching have been studied to determine to what degree the increase in the glass surface area caused by cracks might contribute to the overall leachability of the glass. Borosilicate glass in the shape of cylindrical disks (pellets) has been used in a static leach test. The pellets were leached in deionized water at 90°C. Parameters included crack widths of nominally zero and 0.038-cm, and four ratios of crack surface area to total surface area; zero, 0.28, 0.55, and 0.70. Leaching from the cracks with 0.038-cm crack widths are found to be two to five times less than leaching from uncracked samples. No apparent leaching from crack surfaces with nominally zero crack-widths was observed.

13493 **(PNL-SA—8972) Short description of the AEGIS approach.** Dove, F.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Oct 1980. Contract AC06-76RL01830. 18p. (CONF-8010130—5). NTIS, PC A02/MF A01.

From Waste-Rock Interactions Technology annual information meeting; Seattle, WA, USA (13 Oct 1980).

The evaluation of the long-term effectiveness of isolating nuclear wastes in geologic formation involves a number of distinct steps. Initially, the specific nature of the engineered components in the repository and of the existing geologic and hydrologic systems surrounding the repository must be adequately understood. Since natural geologic processes and future human activities may alter these systems over the long time frames necessary for isolation, an evaluation must also be made to determine if there are plausible scenarios for breaching the repository. If such a scenario is identi-

fied, then the transport of radionuclides from the repository to the evnrionment must be estimated. A final step can be added to estimate the effects of the radionuclides in the environment. The Assessment of Effectiveness of Geologic Isolation Systems (AEGIS) currently has the methods for performing these evaluation steps. The existing AEGIS approach is to obtain the necessary information which characterizes the geologic isolation system from the programs designing the engineered components and the programs making field measurements of the geology and hydrology. AEGIS then develops a conceptual description of the geologic systems and uses computer models to simulate the existing ground-water pathways. AEGIS also uses a team of consulting experts, with the assistance of a computer model of the geologic processes, to develop and evaluate plausible release scenarios. Then other AEGIS computer models are used to simulate the transport of radionuclides to the surface and the resultant radiation doses to individuals and populations. The purpose of this report is to describe this approach.

13494 **(PNL-SA—9077) Radionuclide transport under changing soil salinity conditions.** Jones, T.L.; Gee, G.W.; Wierenga, P.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1980. Contract AC06-76RL01830. 14p. (CONF-801217—4). NTIS, PC A02/MF A01.

From Symposium on modeling and low-level waste management; Denver, CO, USA (1 Dec 1980).

This paper presents experimental measurements and computer simulations of strontium-85 movement through laboratory soil columns. There are two primary objectives of the work. The first is to examine the enhanced leachability of strontium-85 when the soil salinity is raised. The second is to compare the ability of two solute transport models to describe this phenomena. The experiment consisted of injecting a pulse of what will be termed a low salt solution spiked with strontium-85 to a soil column. The column was then leached with over eighteen pore volumes of the low salt solution resulting in no leaching of the strontium-85 from the column. The column was then leached with a high salt solution causing the rapid release of the strontium-85 within five to six pore volumes. The results demonstrate that strontium-85 is subject to greater mobility when the soil salinity is increased. This confirms the necessity of evaluating the soil salinity very carefully in modeling efforts. The results also indicate that batch Kd values, combined with column Kd values and parameters obtained by curve fitting procedures do a fairly good job in describing the snowplow effect. The comparison of the two models reveal insignificant differences when describing the movement of tritium and strontium-85 under high salinity conditions. There was a significant improvement, however, when the mobile-immobile water equations were used to describe the combined low salt-high salt experiment.

13495 **(RHO-BWI-SA—80) Role of a buffer component within an engineered barrier waste package and a preliminary evaluation of bentonite as a backfill material.** Wood, M.I.; Patera, E.S. Jr.; Coons, W.E. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Feb 1981. Contract AC06-77RL01030. 16p. (CONF-810217—7). NTIS, PC A02/MF A01.

From ANS waste management conference; Tucson, AZ, USA (23 Feb 1981).

This paper deals with the functions, properties, and compositions of backfill components to be used in the geologic disposal of high-level nuclear waste in basalt. A conceptual design for a repository located in basalt is being developed by the Basalt Waste Isolation Project (BWIP) in which these backfill components are part of the waste package and the repository sealing system (rooms, tunnels, and shafts). The first part of the paper concerns the role of a buffer component which is located between the primary and secondary physical barriers of the waste package (the canister and overpack). The second part of the paper deals with the chemical and physical properties of bentonite, which is a primary candidate for a backfill material both in the outer backfill barrier of the waste package and in the rooms, tunnels, and shafts above the waste package.

13496 **(SAND—80-1212) Application of titanates, niobates, and tantalates to neutralized defense waste decontamination: materials properties, physical forms, and regeneration techniques. Final report.** Dosch, R.G. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1981. Contract AC04-76DP00789. 80p. NTIS, PC A05/MF A01.

A study of the application of sodium titanate (ST) to the decontamination of neutralized defense waste has been completed. The work was directed at Sr removal from dissolved salt cake, simulated in this work with a 6.0 N $NaNO_3$ - 0.6 N NaOH solution. Three physical forms of the titanates were developed including powder, pellets, and titanate-loaded resin beads and all were found to be superior to conventional organic ion exchange in this application. When spent, the titanate materials can be calcined to an oxide from which is a stable waste form in itself or can be added directly to a glass melter to become part of a vitrified waste form. Radiation stability of titanate powder and resin forms was assessed in tests in which these materials were exposed to ^{60}Co radiation. The strontium exchange capacity of the powder remained constant through a dose of 3×10^7 rads and retained 50% capacity after a dose of 2×10^9 rads. The primary mechanism involved in loss of capacity was believed to be heating associated with the irradiation. The resin forms were unchanged through a dose of 5×10^8 rads and retained 30% capacity after a dose of 2×10^9 rads. The latter dose resulted in visible degradation of the resin matrix. Anion exchange resins loaded with sodium niobate and sodium tantalate were also prepared by similar methods and evaluated for this application. These materials had Sr sorption properties comparable to the titanate material; however, they would have to provide a significant improvement to justify their higher cost.

13497 **(SAND—81-7052) Final meteorological and air quality data report. WIPP site: Eddy County, New Mexico, March 1978-February 1980.** Pocalujka, L.P.; Babij, E.; Catizone, P.A.; Church, H.W. (TRC Environmental Consultants, Wethersfield, CT (USA); Sandia National Labs., Albuquerque, NM (USA)). Feb 1981. Contract AC04-76DP00789. 71p. NTIS, PC A04/MF A01.

The purpose of the WIPP meteorological, air quality, and radiological measurements program was to support the environmental effort for the evaluation of the site suitability. This data report is the final in a series of data summaries issued for the southeastern New Mexico site.

13498 **(UCRL—85483) Phase equilibria, leaching characteristics and ceramic processing of SYNROC D formulations for US defense wastes.** Newkirk, H.; Ryerson, F.; Coles, D.; Hoenig, C.; Rozsa, R.; Rossington, C.; Bazan, F.; Tewhey, J. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1980. Contract W-7405-ENG-48. 9p. (CONF-801124—45). NTIS, PC A02/MF A01.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

The assemblage of coexisting phases in SYNROC D is perovskite, zirconolite, nepheline and spinel. Cesium from the supernate is to be immobilized in hollandite. In the current processing scheme, presynthesized granules of hollandite are added to calcined SYNROC D powders prior to hot procesing or sintering. The disposition of inert and radwaste components of Savannah River Plant (SRP) wastes in SYNROC D formulations has been determined by means of optical microscopy, XRD, XRF, SEM, STEM, electron microprobe analysis and autoradiography. A summary of results is presented. Leaching studies of SYNROC D have been done by means of static, high temperature experiments and continuous-flow experiments. The data reported are from high-temperature experiments (distilled water, powdered sample, 150°C, one day). The elements reported are the only ones observed in the leachate. Analysis was done by means of XRF. The flowsheet which depicts the current experimental methods that are being employed at LLNL to produce SYNROC D samples containing presynthesized Cs-bearing hollandite is presented. The starting material for SYNROC D (high Fe, high Al and composite compositions) is simulated sludge obtained in 55 gallon quantities from Southwestern Chemical Corporation. Hot pressing temperatures for SYNROC D are 1000 to 1150°C. Hot pressing temperatures for hollandite are 1200 to 1400°C.

13499 **Overview of the US Department of Energy's waste management program.** Meyers, S. (Department of Energy, Washington, DC). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-27**: No. 4, 1265-1267(Aug 1980).

A description is given of the nuclear waste management program of the Department of Energy (DOE) including the effect of the recent report of a Presidentially-appointed Interagency Review Group (IRG) on the program. The work summarizes the historical background of some key issues relating to nuclear wastes; lists the major recommendations of the IRG report; and reviews the elements of the DOE program and the changes which might be made as a result of the IRG report.

13500 **In-situ radiation measurements and instrumentation for monitoring nuclear waste storage facilities.** Brodzinski, R.L. (Battelle Pacific Northwest Labs., Richland, WA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-27**: No. 4, 1277-1279(Aug 1980).

A summary is presented of the reasons, requirements, and methodology for monitoring the integrity of nuclear waste storage facilities. Various types of nuclear wastes and the radiation emitted by them are defined. Descriptions of commonly used storage facilities are given. Instrumentation available or under development for making these measurements is described with particular emphasis on in-situ techniques.

13501 **Rock mass characterization for storage of nuclear waste in granite.** Witherspoon, P.A.; Nelson, P.; Doe, T.; Thorpe, R.; Paulsson, B.; Gale, J.; Forster, C. (Univ. of California, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-27**: No. 4, 1280-1290(Aug 1980).

The underground storage of nuclear waste requires assurance of long-term hydrologic containment of potential contaminants and structural integrity of the rock mass during the operational phase of the repository. For storage sites in crystalline rocks such as granite, the success of the repository will depend largely on the behavior of the fracture system during the thermal cycle associated with radioactive decay of the waste. The basic fracture system parameters that require identification are spacing, orientation, aperture (opening), and continuity. In addition to these basic factors, the effect of stress either from tectonic and lithostatic loads or from temperature changes on the apertures of existing fractures and the creation of new fracture surfaces must be considered.

13502 **Design and installation of a lab-scale system for radioactive waste treatment.** Berger, D.N.; Knox, C.A.; Siemens, D.H. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 840-842(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13503 **Remotely operated organic liquid waste incinerator for the Fuels and Materials Examination Facility.** Sales, W.L.; Barker, R.E.; Hershey, R.B. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 842-843(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13504 **Radioactive waste incineration studies at the Los Alamos Scientific Laboratory.** Stretz, L.A.; Borduin, L.C.; Draper, W.E.; Koenig, R.A.; Newmeyer, J.M. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 843-845(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13505 **Retrievability of waste at WIPP.** Irby, H.H.; Segura, M. (W-AES, Pittsburgh, PA). *Transactions of the American Nuclear Society ;* **34**: 845-846(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13506 **Waste Isolation Pilot Plant (WIPP) remote handling operations.** Likar, V.F.; Johnson, J.E. (W-AES, Pittsburgh, PA). *Transactions of the American Nuclear Society ;* **34**: 846-847(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13507 **Criteria for waste repository siting.** Waite, D.A.; Newcomb, W.E. (BCL/ONWI, Columbus, OH). *Transactions of the American Nuclear Society ;* **34**: 93-94(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13508 **US Department of Energy low-level waste management strategy.** Levin, G.B. (EG and G Idaho, Inc., Idaho Falls). *Transactions of the American Nuclear Society ;* **34**: 101(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13509 **Department of Energy's Nuclear Waste Management Programs.** Meyers, S. (Dept. of Energy, Washington, DC). *Transactions of the American Nuclear Society ;* **34**: 1-2(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13510 **Overview of DOE's technical approach to nuclear waste isolation.** Cooley, C.R.; Neff, J.O. (Dept. of Energy, Washington, DC). *Transactions of the American Nuclear Society ;* **34**: 5-6(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13511 **Management of low- and intermediate-level radioactive wastes in France.** Lavie, J.M.; Bovard, P. (Comissariat a l'Energie Atomique, Paris, France). *Transactions of the American Nuclear Society ;* **34**: 5(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13512 **DOE organization for waste materials characterization.** Hindman, T.B. Jr. (E.I. duPont de Nemours and Co., Aiken, SC). *Transactions of the American Nuclear Society ;* **34**: 190(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13513 **Role of the materials review board in the DOE Nuclear Waste Management Program.** Steindler, M.J.; Seefeldt, M.B. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 190-192(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13514 **Leaching test methods for waste forms.** Mendel, J.E.; Turcotte, R.P.; Westsik, J.H. Jr. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 193-194(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13515 **Evaluating radiation-induced changes in high-level waste solids.** Roberts, F.P. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 194-195(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13516 **Nuclear waste Materials Characterization Center.** Nelson, R.D.; Ross, W.A. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 192(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13517 **Corrosion of titanium in saline nuclear waste isolation environments.** Abrego, L.; Braithwaite, J.W. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 196(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13518 **Review of waste forms.** Rusin, J.M. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 196-197(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13519 **Process for proving the long-term safety of deep geologic repositories.** Hewitt, W.M.; Dayem, N.J. (Battelle Office of Waste Isolation, Columbus, OH). *Transactions of the American Nuclear Society ;* **34**: 346(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 13470, 13487, 14754, 14756, 14761, 14904

13520 **(NUREG/CR—1407) Field and modeling study of windblown particles from a uranium mill tailings pile.** Schwendiman, L.C.; Sehmel, G.A.; Horst, T.W.; Thomas, C.W.; Perkins, R.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 240p. NTIS, PC A11/MF A01.

An extensive field study whose primary objective was to obtain knowledge and understanding of the nature and quantity of windblown particles from uranium mill tailings piles was conducted in the Ambrosia Lake District of New Mexico. The following major field tasks were undertaken: determination of physical, chemical, and radioactivity characteristics of mill tailings particles; an investigation of the nature and quantity of tailings particles in soil in the vicinity of tailings piles; and the determination of the nature and flux of particles being transported by wind as a function of wind speed and height. Results of the field study are presented. Particle size distributions and associated radioactivity were measured.

13521 **(PNL-SA—8733) Effect of organic ligands on the soil behavior of technetium-99.** Martin, L.Y.; Franz, J.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RL01830. 10p. (CONF-801107—68). NTIS, PC A02/MF A01.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

Results of studies on the effects of organics on ^{99}Tc mobility are reported. The effects of organics (EDTA,DTPA and citrate) on the sorption/migration of Tc is examined from two aspects, first by desorption techniques where reduced, sorbed Tc is exposed to organic ligands; and second, by exposure of synthetic Tc-organic complexes to soils. A calcareous, sandy, loam Hanford soil (pH ~ 8.2) was used. Very little desorption of the reduced Tc has occurred both in the 10 day study (95-87% remains sorbed for 10^{-6} to 10^{-9} M levels even at cit/Tc - 10,000= and even less desorption is observed in the extended 45 day study (95-90% remains sorbed for 10^{-6} to 10^{-9} M levels). Similar results were also observed when a stronger chelating agent such as EDTA was used. Approximately 95% of the reduced Tc remains sorbed for the 10^{-5} to 10^{-6} M levels and ~ 70 remains sorbed at 10^{-7} M.

13522 **(PNL-SA—8935) Development of a source term for radionuclide release from spent fuel in a basalt repository.** Kuhn, W.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 21p. (CONF-801206—11). NTIS, PC A02/MF A01.

From ORNL conference on the leachability of radioactive solids; Gatinburg, TN, USA (9 Dec 1980).

An analysis of groundwater transport of radionuclides from a nuclear waste repository requires a source term, i.e., a prediction of the rate of release of radionuclides from the repository. A source term has been constructed to support a demonstration of analytical methodology developed for use in repository licensing. For this the case of release from spent fuel in a basalt repository sheared by a fault was considered. The resulting source term illustrates the role of leaching behavior without referring to a specific detailed waste package design. The technical approach used to construct the source term is discussed to illustrate how information on nuclear waste leaching behavior might be used in support of repository licensing activites. Assumptions made in lieu of a complete understanding of leaching behavior are discussed.

13523 **Loose rock as biobarriers in shallow land burial.** Cline, J.F.; Gano, K.A.; Rogers, L.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Health Physics ;* **39**: No. 3, 497-504(Sep 1980).

A layer of loose rock placed between buried waste and topsoil successfully prevented plant roots, burrowing mammals and ants from translocating waste materials into the biosphere in an arid climate. Air spaces between the rocks had to be maintained with stones of between 3.8 and 7.6 cm diameter. Small rocks and asphalt emulsion prevented the topsoil from sifting between the rocks that may make a pathway for plant roots to the waste material.

0550 Regulations

REFER ALSO TO CITATION(S) 13455, 14462

13524 **(NUREG/CR—0829) Measurement control program for nuclear material accounting.** Brouns, R.J.; Roberts, F.P.; Merrill, J.A.; Brown, W.B. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 71p. NTIS, PC A04/MF A01.

A measurement control program for nuclear material accounting monitors and controls the quality of the measurments of special nuclear material that are involved in material balances. The quality is monitored by collecting data from which the current precision and accuracy of measurements can be evaluated. The quality is controlled by evaluations, reviews, and other administrative measures for control of selection or design of facilities, equipment and measurement methods and the training and qualification of personnel who perform SNM measurements. This report describes the most important elements of a program by which management can monitor and control measurement quality.

13525 **(NUREG/CR—0849(Vol.2)) Safeguards material control and accounting program: quarterly report, January-March 1979.** Maimoni, A.; Dunn, D.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1980. 27p. NTIS, PC A03/MF A01.

The operation and use of the Safeguards Vulnerability Analysis Program (SVAP) Input/Output programming written for a Tektronix 4050 series computer is described. The programming consists of the Facility Description Program and its continuation, the Accounting System Program, plus several service routines. These programs generate the input files that will be used by the SVAP codes in a main frame computer, such as the CDC 7600 at Lawrence Livermore Laboratory.

13526 **(NUREG/CR—1146) Safeguards against proliferation of nuclear materials: a review and bibliography.** Blakeman, E.D. (Oak Ridge National Lab., TN (USA)). May 1980. Contract W-7405-ENG-26. 153p. NTIS PC MF A01.

The current status of nuclear safeguards is presented in this report. The text reviews domestic and international safeguards, and nuclear proliferation issues and policies. The bibliography contains

349 abstracts of publications covering a wide range of nuclear safeguards topics. Key word, author, and permuted-title indexes are included for the readers' convenience.

13527 **(NUREG/CR—1169-Vol.3) Safeguard vulnerability analysis program (SVAP) user's manual.** Orvis, W.J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1980. 98p. NTIS, PC A05/MF A01.

The operation and use of the Safeguards Vulnerability Analysis Program (SVAP) Input/Output programming written for a Tektronix 4050 series computer is described. The programming consists of the Facility Description Program and its continuation, the Accounting System Program, plus several service routines. These programs generate the input files that will be used by the SVAP codes in a main frame computer, such as the CDC 7600 at Lawrence Livermore Laboratory. SVAP addresses one class of safeguards threat: theft or diversion of special nuclear material (SNM) by nonviolent insiders, acting individually or in collusion. This user's manual will assist the NRC analyst in implementing SVAP applications; it is the principal guide to computer use in SVAP.

13528 **(NUREG/CR—1283) Accounting systems for special nuclear material control. Technical report.** Korstad, P.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1980. 85p. NTIS, PC A05/MF A01.

Nuclear material accounting systems were examined and compared to financial double-entry accounting systems. Effective nuclear material accounting systems have been designed using the principles of double-entry financial accounting. The modified double-entry systems presently employed are acceptable if they provide adequate control over the recording and summarizing of transactions. Strong internal controls, based on principles of financial accounting, can help protect nuclear materials and produce accurate, reliable accounting data. An electronic data processing system can more accurately maintain large volumes of data and provide management with more current, reliable information.

13529 **(NUREG/CR—1284) Methods of determining and controlling bias in nuclear material accounting measurements. Technical report.** Brouns, R.J.; Merrill, J.A.; Roberts, F.P. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 52p. NTIS, PC A04/MF A01.

The common sources of bias associated with measurements made for nuclear control and accounting purposes are described and recommended approaches to monitoring and controlling such errors are presented. Measurement bias is placed in perspective through a discussion of the effect of measurement error in material balance and accounting. A recommended program for monitoring and controlling bias includes calibrations, routine measurements of reference standards, method testing and comparative analyses.

13530 **(NUREG/CR—1327) Security lighting planning document for nuclear fixed site facilities. Technical report.** Wait, H.J.; Manning, M.W.; Page, D.R. (Mason and Hanger-Silas Mason Co., Inc., Lexington, KY (USA). Systems Div.). Apr 1980. 175p. NTIS, PC A08/MF A01.

This document has been prepared as an aid in planning security lighting at nuclear fixed site facilities. While the recommendations enclosed cover the minimum requirements established in Title 10, Code of Federal Regulations (CFR), Part 73, additional suggestions are made for further enhancing a facility's security lighting and related security capabilities. Planning considerations and information are provided for lighting of the isolation zones, protected areas, portals, vital areas and material access areas. Recommendations are made relative to indoor, outdoor, fixed, portable and other unique applications of security lighting.

13531 **(NUREG/CR—00849-Vol.1) Safeguards material control and accounting program: quarterly report, October-December 1978.** Dunn, D.R.; Maimoni, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1980. 94p. NTIS, PC A05/MF A01.

Work is summarized for the quarter October to December, 1978, in the Material Control Safeguards Evaluation Program. The main activities related to the continuing development of the assessment methodologies and their application to the assesment of a fuel cycle facility. Much progress was made in the Digraph--Fault-Tree Methodology, leading to the Safeguards System Vulnerability Assessment Methodology (SSVAM). In addition, the development of the Structured Assessment Approach (SAA) continued on schedule. Both techniques were used to assess the vulnerabilities of the safeguards system at an existing fuel recovery facility (Facility X). Other activities during the quarter included (1) the continuing development of the Aggregated Systems Model (ASM), an evaluation tool designed to aid the NRC in the setting safeguards criteria; (2) the continuing structuring and data gathering for the adversary model portion of the ASM; and (3) the continuing development of computer codes for chemical process modeling/material estimation/material loss detection.

13532 **(PB—80-192867) Source category survey: uranium refining industry. Final report.** Stelling III, J.H.E. (Radian Corp., Durham, NC (USA)). May 1980. Contract EPA-80-02-3058. 25p. NTIS, PC A02/MF A01.

The purpose of this source category survey was to determine if new source performance standards (NSPS) should be developed for the uranium refining industry. Information on the uranium milling process, the uranium conversion process, industry growth, and industry emissions was collected. The U.S. Nuclear Regulatory Commission (NRC) and the U.S. Environmental Protection Agency Office of Radiation Programs were contacted to determine the existing and proposed regulations applicable to this industry. It was concluded that radionuclide emissions are regulated by the NRC under the Uranium Fuel Cycle Standard (40 CFR Part 190) and that all significant particulate emissions of uranium mills will be assessed (and regulated; if warranted) under the current project for development of NSPS for the metallic minerals industry. Based upon this information it was recommended that NSPS not be developed for the uranium refining industry.

13533 **(PNL—3711) Analysis of the impact of safeguards criteria.** Mullen, M.F.; Reardon, P.T. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1981. Contract AC06-76RL01830. 268p. (ISPO—139). NTIS, PC A12/MF A01.

As part of the US Program of Technical Assistance to IAEA Safeguards, the Pacific Northwest Laboratory (PNL) was asked to assist in developing and demonstrating a model for assessing the impact of setting criteria for the application of IAEA safeguards. This report presents the results of PNL's work on the task. The report is in three parts. The first explains the technical approach and methodology. The second contains an example application of the methodology. The third presents the conclusions of the study. PNL used the model and computer programs developed as part of Task C.5 (Estimation of Inspection Efforts) of the Program of Technical Assistance. The example application of the methodology involves low-enriched uranium conversion and fuel fabrication facilities. The effects of variations in seven parameters are considered: false alarm probability, goal probability of detection, detection goal quantity, the plant operator's measurement capability, the inspector's variables measurement capability, the inspector's attributes measurement capability, and annual plant throughput. Among the key results and conclusions of the analysis are the following: the variables with the greatest impact on the probability of detection are the inspector's measurement capability, the goal quantity, and the throughput; the variables with the greatest impact on inspection costs are the throughput, the goal quantity, and the goal probability of detection; there are important interactions between variables. That is, the effects of a given variable often depends on the level or value of some other variable. With the methodology used in this study, these interactions can be quantitatively analyzed; reasonably good approximate prediction equations can be developed using the methodology described here.

13534 **(PNL—3712) Calculation of parameters for inspection planning and evaluation: low enriched uranium conversion and fuel fabrication facilities.** Reardon, P.T.; Mullen, M.F.; Harms, N.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 97p. (ISPO—140). NTIS, PC A05/MF A01.

As part of Task C.35 (Calculation of Parameters for Inspection Planning and Evaluation) of the US Program of Technical As-

sistance to IAEA Safeguards, Pacific Northwest Laboratory has performed some quantitative analyses of IAEA inspection activities at low-enriched uranium (LEU) conversion and fuel fabrication facilities. This report presents the results and conclusions of those analyses. Implementation of IAEA safeguards at LEU conversion and fuel fabrication facilities must take into account a variety of practical problems and constraints. One of the key concerns is the problem of flow verification, especially product verification. The objective of this report is to help put the problem of flow verification in perspective by presenting the results of some specific calculations of inspection effort and probability of detection for various product measurement strategies. In order to provide quantitative information about the advantages and disadvantages of the various strategies, eight specific cases were examined.

13535 **Application of isotopic safeguards techniques to the Tokai-Mura reprocessing facility.** Timmerman, C.L. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 157-158(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13536 **Operational experience of the Tokai automated electromanometer system.** Suda, S. (Brookhaven National Lab., Upton, NY); Keisch, B.; Hayashi, M. *Transactions of the American Nuclear Society ;* **34**: 158-159(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13537 **Nondestructive measurements of irradiated fuel assemblies at a reprocessing facility.** Phillips, J.R.; Bosler, G.E.; Halbig, J.K. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 159(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13538 **Spent-fuel containment and surveillance system at a fuel reprocessing facility.** Holmes, J.P.; Cameron, C.P. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 161(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13539 **Tokai-Mura K-edge densitometer for total Pu and isotopics in product solutions.** Hsue, S.T.; Russo, P.A.; Sprinkle, J.K. Jr.; Asakura, Y.; Fukuda, T.; Kondo, I. *Transactions of the American Nuclear Society ;* **34**: 161-163(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13540 **Automated in-line measurements of plutonium solutions.** Li, T.K.; Hsue, F. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 164(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13541 **Mathematical simulation of calorimeters used for rapid nuclear fuel assay.** Weisman, J. (Univ. of Cincinnati, OH); Yeh, S.H.; Fellers, C. *Transactions of the American Nuclear Society ;* **34**: 166-167(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13542 **DYMAC accountability system.** Demuth, A.N. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 167-168(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

06 FUSION FUELS

0602 Processing

13543 **(UCRL—84472) Double-shell inertial confinement fusion target fabrication.** Hatcher, C.W.; Lorensen, L.E.; Weinstein, B.W. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 26 Aug 1980. Contract W-7405-ENG-48. 20p. (CONF-801037—38). NTIS, PC A02/MF A01.

From American Vacuum Society conference; Detroit, MI, USA (13 Oct 1980).

First generation hemishells, from which spherical shells are constructed, were fabricated by micromachining coated mandrels and by molding. The remachining of coated mandrels are described in detail. Techniques were developed for coating the microsized mandrels with polymeric and metallic materials by methods including conformal coating, vapor deposition, plasma polymerization and thermoforming. Micropositioning equipment and bonding techniques have also been developed to assemble the hemishells about a fuel pellet maintaining a spherical concentricity of better than 2 μm and voids in the hemishell bonding line of a few hundred angstroms or less.

13544 **Cryogenic laser fusion targets by point-contact conduction cooling.** Henderson, T.M.; Musinski, D.L.; Jacobs, R.B.; Simms, R.J. (KMS Fusion, Inc., Ann Arbor, MI). *AIChE Symposium Series ;* **75**: No. 191, 219-228(1979).

The apparatus and technique to condense layers of liquid deuterium-tritium on the inner surfaces of small spherical glass shells are described. The method consists in condensing the fuel by conducting heat from the shell to a cryostat through an intermediate copper fiber that serves also as a support for the shell. This procedure allows laser fusion and other inertial confinement experiments to be conducted with liquid fuel targets while the targets are exposed to a room-temperature environment. The resulting cryogenic fuel configurations have been irradiated with the KMSF Nd:glass laser and have produced more than 10^7 thermonuclear neutrons.

0603 By-products

13545 **High-temperature steam gasification of coal with a fusion reactor.** Dang, V.D.; Steinberg, M. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 31-32(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13546 **Synthetic fuels from laser fusion.** Gomberg, H.J. (KMS Fusion, Inc., Ann Arbor, MI). *AIChE Symposium Series ;* **75**: No. 191, 193-195(1979).

The use of a laser fusion reactor as a neutron source for the direct conversion of fusion energy into synthetic fuel production is outlined. Some of the different methods for producing hydrogen are briefly reviewed. (MOW)

0609 Environmental Aspects

REFER ALSO TO CITATION(S) 14718

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0703 Isotopic Power Supplies

13547 **(GA-A—15683) Radioisotope space power generator annual report for the period October 1, 1976-September 30, 1978.** Elsner, N.B.; Chin, J.; Staley, H.G.; Bass, J.C.; Steeger, E.J.; Gantzel, P.K.; Neill, J.M. (General Atomic Co., San Diego, CA (USA)). Jan 1980. Contract AT03-76SF70060. 151p. NTIS, PC A08/MF A01.

Techniques for fabricating P-type $(Cu,Ag)_2Se$ with mesh-type bonds have been developed and are being evaluated for long-term use. In addition, methods for reducing vapor suppression by the use of coatings and/or baffling continue to show gains. The N-type alloy Gd_2Se_3 has been shown to be thermally unstable. It undergoes a sluggish cubic-to-orthorhombic phase change below 1000°C, with an accompanying degradation in mechanical and thermoelectric properties. Fabrication studies conducted with the $(Bi,Sb)_2(Se,Te)_3$ alloys showed these materials to be sensitive to oxygen contamination if reproducible properties are to be obtained. Preparation of powdered material by explosive techniques was investigated. This technique appears to be useful in preparing homogeneous -325 mesh material, but it does not yield a useful amount of submicron-size powder.

13548 **(LA—8597) Interaction of a ^{238}Pu fueled-sphere assembly with a simulated terrestrial environment.** Steinkruger, F.J.; Patterson, J.H.; Herrera, B.; Nelson, G.B.; Matlack, G.M.; Waterbury, G.R.; Pavone, D. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01.

A ^{238}Pu fueled sphere assembly (FSA) was exposed to a simulated humid environment on sandy soil for 3 y. After a 70-week exposure, plutonium was first detected in measurable quantities in rain and condensate samples. A core sample taken in the ninety-third week contained 302 ng of plutonium. Examination of the FSA after exposure revealed a hole in the bottom of the graphite impact shell (GIS) and a leaking weld on the vent assembly of the postimpact containment shell (PICS). These two openings may be the pathways for plutonium entry into the environment from the FSA.

13549 **(LA—8749-PR) Space nuclear safety and fuels program. Progress report, December 1980.** Bronisz, S.E. (comp.). (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 23p. NTIS, PC A02/MF A01.

This formal monthly report covers the studies related to the use of $^{238}PuO_2$ in radioisotopic power systems carried out for the Space and Terrestrial Systems Division of the US Department of Energy by the Los Alamos National Laboratory. Most of the studies discussed here are of a continuing nature. Results and conclusions described may change as the work continues. Published reference to the results cited in this report should not be made without the explicit permission of the person in charge of the work.

08 HYDROGEN

13550 **(PB—80-204282) Report of the governor's task force committee on hydrogen energy.** (New Mexico Governor's Energy Task Force, Santa Fe (USA)). 12 Jun 1975. 48p. NTIS, PC A03/MF A01.

The report describes different aspects of the large scale use of hydrogen as an energy carrier, and their importance to New Mexico. The contents are as follows: Supporting research with respect to the hydrogen economy; Production; Transport; Storage; Utilization; Environment; Safety; System integration.

13551 **(PB—80-813090) Hydrogen use as a fuel. 1964-June 1980 (citations from the NTIS Data Base). Report for 1964-June 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 214p. NTIS PC N01/MF N01.

Federally-funded research studies pertaining to the technical feasibility of using hydrogen as a fuel for vehicular transportation, electric power generation, and both subsonic and supersonic aircraft are discussed. Excluded are studies on hydrogen production and storage. These topics are covered in other bibliographies. (This updated bibliography contains 206 citations, 20 of which are new entries to the previous edition.)

0801 Production

REFER ALSO TO CITATION(S) 14227

13552 **(PB—80-810476) Hydrogen production. 1978-May, 1980 (citations from the NTIS data base). Report for 1978-May 80.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). May 1980. 207p. NTIS PC N01/MF N01.

The cited reports include studies on the manufacturing of hydrogen by electrolysis, coal gasification, and other techniques. They cover both experimental research and production on the industrial scale. Although most of the reports are on production methods, economic studies are also included. (This updated bibliography contains 200 abstracts, 56 of which are new entries to the previous edition.)

13553 **Mechanism of the formation of dihydrogen from the photoinduced reactions of poly(pyridine)ruthenium(II) and poly(pyridine)rhodium(III) complexes.** Chan, S.F.; Chou, M.; Creutz, C.; Matsubara, T.; Sutin, N. (Brookhaven National Lab., Upton, NY). *Journal of The American Chemical Society ;* **103**: No. 2, 369-379(28 Jan 1981).

The irradiation of $Ru(bpy)_3^{2+}$, and triethanolamine (TEOA) solutions 10^9 8, 25°C) with 450 +- 20-nm light yields rhodium(I) phi = 0.13 +- 0.02) (units for phi in mol einstein^{-1} throughout the paper) and dihydrogen (phi = 0.11 +- 0.02) in the absence and presence of platinum, respectively. A detailed mechanistic scheme has been deduced from the results of continuous- and flash-photolysis experiments: light absorption by $Ru(bby)_3^{2+}$ gives the excited state $^*Ru(bpy)_3^{2+}$ which is oxidized by $Rh(bpy)_3^{3+}$ ($k = 3.9 \times 10^8 M^{-1}s^{-1}$) yielding $Ru(bpy)_3^{3+}$ and $Rh(bpy)_3^{2+}$ with a cage escape yield of 0.15 +- 0.03. Back-reaction of $Ru(bpy)_3^{3+}$ with $Rh(bpy)_3^{2+}$ ($k = 3 \times 10^9 M^{-1}s^{-1}$) is prevented by reduction of $Ru(bpy)_3^{3+}$ by TEOA ($k = 0.2 \times 10^8 M^{-1}s^{-1}$). The oxidized TEOA radical so generated undergoes a TEOA-promoted rearrangement ($k = 0.3 \times 10^7 M^{-1}s^{-1}$) to a reducing radical. The latter reduces $Rh(bpy)_3^{3+}$ so that the net yield for $Rh(bpy)_3^{2+}$ formation is 0.3 +- 0.1. Rate-determining loss of bpy from $Rh(bpy)_3^{3+}$ ($k = 1.0$ +- 0.5 s^{-1}) is followed by rapid reduction of $Rh(bpy)_2^{2+}$ by $Rh(bpy)_3^{2+}$ ($k = 0.3 \times 10^9 M^{-1}s^{-1}$) giving $Rh(bpy)_3^{3+}$ and Rh(I). In the presence of platinum, H_2 is formed at the expense of Rh(I); catalyzed reaction of Rh(II) with water occurs before disproportionation to Rh(I) can take place. The H_2 quantum yield in this system is limited only by the cage escape of the primary products, the homogeneous and heterogeneous dark reactions being very efficient. In the course of this study the electrochemistry of $Rh(bpy)_3^{3+}$, $Rh(phen)_3^{3+}$, and $Rh(bpy)_2(OH)_2^+$ in aqueous solution was investigated, and the quenching of $Ru(bpy)_3^{3+}$ emission by these Rh(III) complexes was characterized.

13554 **Cyclic pattern of hydrogen evolution by Anabaena flos-aquae.** Strandberg, G.W. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *European Journal of Applied Microbiology ;* **9**: 19-20(1980).

Photoproduction of H_2 from water by Anabaena flos-aquae in a batch reactor (flowing argon gas phase) followed a reproducible cyclic pattern. Chloramphenicol inhibited events in the cycle, indicating a requirement for protein synthesis.

13555 **Mechanism of the catalytic hydrogen production by gold sols. H/D isotope effect studies.** Kopple, K. (Illinois Inst. of Tech., Chicago); Meyerstein, D.; Meisel, D. *Journal of Physical Chemistry, The ;* **84**: 870-875(1980).

The H/D isotope effect on the catalytic production of hydrogen from water using either Cr^{2+} or $(CH_3)_2COH$ radical as reductants was studied. The catalysts used were gold sols stabilized by either citrate or poly(vinyl sulfate). Similar isotope effects (in the range of 5 to 6.7) were measured for the various reductants and stabilizers. Comparison of this isotope effect to the one measured for the production of hydrogen on gold cathodes leads to the conclusion that similar mechanisms operate in all three systems. It was also observed that hydrogen abstraction from the relatively stable supports, when adsorbed on the colloid, occurs. This leads to the conclusion the hydrogen atoms adsorbed on the particles can either

proceed to produced hydrogen molecules by the catalytic reaction or react via other competing pathways.

0802 Storage

13556 **Hydrides for energy storage.** Andresen, A.F.; Maeland, A.J. (eds.). Elmsford, NY; Pergamon Press Inc. (1978). 611p. (CONF-770823—).

From International symposium on hydrides for energy storage; Geilo, Norway (14 Aug 1977).

Papers presented at this symposium are indexed separately.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

13557 **(COO—2981-61) Indirect thermal liquefaction process for producing liquid fuels from biomass.** Kuester, J.L. (Arizona State Univ., Tempe (USA). Dept. of Chemical Engineering). 1980. Contract AS02-76CS40202. 24p. (CONF-800802—24). NTIS, PC A02/MF A01.

From 89. annual meeting of the American Institute of Chemical Engineers; Portland, OR, USA (17 Aug 1980).

A progress report on an indirect liquefaction process to convert biomass type materials to quality liquid hydrocarbon fuels by gasification followed by catalytic liquid fuels synthesis has been presented. A wide variety of feedstocks can be processed through the gasification system to a gas with a heating value of 500 + Btu/SCF. Some feedstocks are more attractive than others with regard to producing a high olefin content. This appears to be related to hydrocarbon content of the material. The H_2/CO ratio can be manipulated over a wide range in the gasification system with steam addition. Some feedstocks require the aid of a water-gas shift catalyst while others appear to exhibit an auto-catalytic effect to achieve the conversion. H_2S content (beyond the gasification system wet scrubber) is negligible for the feedstocks surveyed. The water gas shift reaction appears to be enhanced with an increase in pyrolysis reactor temperature over the range of 1300 to 1700°F. Reactor temperature in the Fischer-Tropsch step is a significant factor with regard to manipulating product composition analysis. The optimum temperature however will probably correspond to maximum conversion to liquid hydrocarbons in the C_6 - C_{17} range. Continuing research includes integrated system performance assessment, alternative feedstock characterization (through gasification) and factor studies for gasification (e.g., catalyst usage, alternate heat transfer media, steam usage, recycle effects, residence time study) and liquefaction (e.g., improved catalysts, catalyst activity characterization).

13558 **(DOE/ET/14696—T5) Peat biogasification development program. Quarterly progress report No. 5, for period October 1 - December 31, 1980.** (Dynatech R/D Co., Cambridge, MA (USA)). 15 Jan 1981. Contract AC01-79ET14696. 23p. NTIS, PC A02/MF A01.

Progress is reported in the peat biogasification development program. The objective of the research is to compile the necessary data for the design and operation of a peat anaerobic digestion process development unit. Five areas are addressed: pretreatment information; anaerobic digestion; evaluation of waste streams; process model development and economic analysis; and planning for the process development unit. During the reporting period extensive data was taken for the development of the predictive process model. A number of batch and continuous pretreatment experiments were completed and analyzed. The four samples being analyzed through solvent extration were completed, and the results are presented. Work on High Pressure Liquid Chromatography continued, and the development of the gradient elution solvent system was completed with encouraging results. Pretreated peat has been batch fermented; the continuously oxidized peat has shown conversions of close to 30%. This is significantly higher than the conversions for the batch oxidized peat. Continuous digesters have been in operation for approximately one month. Development of a predictive process model for the three phases of peat biogasification, solubilization, oxidation, and fermentation, continued with very good results. The models for solubilization and oxidation were developed and experimental data are being gathered for the fermentation phase of the process model. (DMC)

13559 **(DOE/PC/30299—T2) Experimental investigation of synfuel spray characteristics and combustion dynamics. Quarterly technical progress report for the period October 1 - December 31, 1980.** (Spectron Development Labs., Inc., Costa Mesa, CA (USA)). Jan 1981. Contract AC22-80PC30299. 40p. NTIS, PC A03/MF A03.

During the initial report period, efforts were directed primarily towards the design and construction of the cold spray rig. Air flow, fuel flow, and optical requirements were identified. These provided the basis for sizing the spray chamber, air flow ducting, blowers, fuel system and general optical configurations. Detailed design of major systems was completed, major hardware components were ordered, and subsystem assembly was initiated. In addition to the planned design and assembly work on the cold spray rig, preliminary laboratory experiments were conducted to help define the optical configuration for both the droplet sizing interferometry (DSI) measurements and the holographic imaging of the (injector) spray formation region. Monodispersed droplet generation techniques needed in Task 2.0 and oil burner designs for the generation of spray flames needed in Task 3.0 were also addressed.

13560 **(NYSERDA—80-13) Feasibility assessment of anaerobic digestion of European water chestnuts (Trapa natans L.).** Besha, J.A.; Countryman, W.D. (Fraser (J.Kenneth) and Associates, Rensselaer, NY (USA)). Jul 1980. 52p. New York State Energy Research and Development Authority, Albany.

The project determined the technical and economic feasibility of anaerobic digestion of Trapa natans L. or European water chestnuts, to produce methane. Trapa natans is a nuisance aquatic plant presently found in the northeastern United States. The field data collection phase included color aerial photogrammetry and manual sampling. Yields of 9.08 kg per square meter of raw material with a corresponding dry weight of 1.53 kg/sq meter were determined. Bacterial digestion resulting in gas production of 69% methane and 31% carbon dioxide was shown in laboratory-scale digestion experiments. Mass spectrographic analysis indicated no contaminants in the gas stream. Conceptual technical design of a 400 kW methane-fueled electric generation facility indicated economic feasibility of this facility either as an independent or a hybrid process in conjunction with a small hydroelectric facility. Substantial economic and environmental benefits may accure from the control of Trapa natans by this means.

13561 **(PB—80-169998) Approvechamiento de desechos para la generacion de bio-gas como fuente de energia (utilization of residues for the obtention of bio-gas as an energy source).** Gonzalez B, J.D.C.; Munoz V, L.A. (Panama Univ., Panama City. Inst. Politecnico). 1978. 143p. NTIS, PC A07/MF A01.

This report explains the production of methane gas by the process of anaerobic fermentation, from organic sources such as poultry or cow manure. It analyzes the inconveniences at the present of using human excreta. Other sources are: food waste, mud, vegetable residues, all useful for conversion to obtain methane gas. It gives ample details on the chemical composition of the various bio-gas, depending on its origin, and the uses and industrial future of the gas. Mechanical devicces such as batteries and machinery are explained, with illustrations. A list of safety tips is included.

13562 **(PB—80-177397) A prototype mobile system for pyrolysis of agricultural and/or silvicultural wastes. Final report.** Tatom, J.W.; Colcord, A.R.; Williams, W.M.; Purdy, K.R.; Demeter, J.J. (Georgia Inst. of Tech., Atlanta (USA). Engineering Experiment Station). Oct 1979. 141p. NTIS PC MF A01.

This research program was initiated to investigate three elements of a prototype mobile system for pyrolysis of agricultural and/or silvicultural wastes into clean, transportable fuels: the pyrolytic converter itself, a pyrolysis-gas-fueled internal combustion engine, and the combustion and emission characteristics of pyroly-

tic char and oil. An experimental study of the performance of the Georgia Tech Engineering Experiment Station one-ton-per-hour pyrolytic converter was conducted. Peanut hulls and pine sawdust were used as representative agricultural and silvicultural waste materials. Effects of converter capacity, feed material, mechanical agitation, bed depth, and air-to-feed ratio on product yields were determined. An experimental study of the combustion and emission characteristics of powdered char was performed by the Pittsburgh Energy Research Center. Stable combustion and satisfactory combustion efficiency were obtained with powdered high-volatile char alone and with 50-50 blends of high-volatile or low-volatile pulverized char and coal. Excellent flame stability and carbon-combustion efficiency were obtained when powdered char was mixed with pyrolysis oil and No. 6 fuel oil and fired as a slurry in an oil-fired boiler. Studies of the combustor and boiler flue gases showed significant reductions in SO2 emissions.

13563 **(PB—80-197239) An investigation of the downdraft gasification characteristics of agricultural and forestry residues: interim report. Consultant report.** (California Univ., Davis (USA). Dept. of Agricultural Engineering). Nov 1979. 55p. NTIS, PC A04/MF A01.

This Interim Report provides an overview of the experimental work conducted with the Laboratory Gas Producer to determine the gasification characteristics of twenty-four agricultural and wood residues. The test objectives were: (1) determine the gasification characteristics of the fuels; (2) the associated physical and chemical characteristics of the fuels and their gasification residues; and (3) the potential for the fuel to produce slag in the gas producer reaction zones. Each test was conducted for a period of six hours if slagging did not shorten the run period.

13564 **CO hydrogenation over clean and oxidized rhodium foil and single crystal catalysts. Correlations of catalyst activity, selectivity, and surface composition.** Castner, D.B.; Blackadar, R.L.; Somorjai, G.A. (Lawrence Berkeley Lab., CA). Contract S-7405-ENG-48. *Journal of Catalysis ;* **66**: No. 2, 257-266(Dec 1980).

CO hydrogenation at 6 atm over Rh polycrystalline foil and single (111) catalysts was investigated in a system where the surface structure and composition of the catalysts could be characterized both before and after the reaction. The reaction conditions (H_2:CO ratio, reaction temperature, surface pretreatment, and gas phase additives) were systematically varied to determine the conditions necessary for the formation of oxygenated hydrocarbons. Initially clean Rh catalysts showed no structure sensitivity, primarily produced methane (90 wt%) at an initial rate of 0.15 molecules site^{-1} sec^{-1} at 300°C, and did not produce detectable amounts of oxygenated hydrocarbons. Preoxidation of the Rh (800 Torr O_2, 600°C, 30 min) resulted in dramatically increased initial rates, a larger fraction of higher molecular weight hydrocarbons in the product distribution, formation of methanol, ethanol, and acetaldehyde, and some structure sensitivity. The different Arrhenius methanation preexponential factors and activation energies over the clean and preoxidized Rh foils indicate the methanation mechanism is different on these two surfaces. Decreasing the reaction temperature or H_2:CO ratio increased the C_2H_4 to C_2H_6 ratio and shifted the product distribution toward the higher molecular weight hydrocarbons. The addition of 1 mole% of CH_3OH, CH_3CH_2OH, or C_2H_4 to the H_2:CO reaction mixture caused a small increase in the fraction of higher molecular weight hydrocarbons. 10 figures, 3 tables.

13565 **Kinetics and mechanisms of steam gasification of biomass in the presence of alkali carbonates.** Sealock, L.J.; Weber, S.L.; Mudge, L.K. (Battelle Pacific Northwest Labs., Richland, WA). Contract EY-76-C-06-1830. *Biosources Digest ;* **2**: No. 1, 12-26(Jan 1980).

Fundamental investigations of catalyzed and noncatalyzed gasification of biomass (wood) are being conducted at the Pacific Northwest Laboratory. Studies include the determination of reaction kinetics, reaction orders, and activation energies for both catalyzed and noncatalyzed pyrolysis and steam gasification of wood. Experiments were conducted in a specially designed ball valve batch reactor. Gasification catalysts that were examined include Na_2CO_3 and K_2CO_3. Independent variables that were studied include temperature and steam feed rate. Results so far indicate that alkali carbonate catalysts significantly affect the rate of carbon-steam gasification and the distribution of products formed during pyrolysis and gasification at all temperatures. A two stage sequential process is postulated to describe the reaction kinetics. A probable mechanism describing how alkali carbonates enhance steam gasification of biomass is presented.

13566 **Conversion of forest residues to a clean gas for fuel or synthesis.** Feldmann, H.F.; Liu, K.T.; Longanbach, J.R.; Curran, L.M.; Chauhan, S.P. (Battelle Columbus Lab., OH). *Tappi ;* No. 1, 81-89(1979).

A program is described for developing a gasification system specifically for wood and other biomass materials which allows greatly increased gasifier throughputs and direct catalysis of wood. Wood ash, which is a by-product of a wood gasification plant, can be used as a gasification catalyst for wood, as it increases gasification rates and promotes the water-gas shift reaction. The high reactivity of even uncatalyzed biomass allows the potential of very high gasifier throughputs. However, the achievement of this potential requires that the gasifier operate at gas velocities higher than those attainable in conventional reactor systems. Stable and very smooth fluidization with uniform mixing and distribution of chips throughout the bed was observed on addition of an entrained sand phase to a fluidized bed of alumina and wood chips. Economc feasibility studies based on utilization of a proprietary Battelle gasification system which utilizes an entrained-phase heat carrier indicated that an intermediate-Btu gas can be produced in 1000 ton/day plants at a price competitive with liquefied natural gas and No. 2 heating oil.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 13313, 13615, 13616, 13616, 13617, 13619, 13993, 14215, 14398, 14399

13567 **(DOE/ET/10741—T1) Methanol and methyl fuel catalysts. Final technical report, September 1978-August 1980.** Klier, K.; Herman, R.G. (Lehigh Univ., Bethlehem, PA (USA). Center for Surface and Coatings Research). 15 Dec 1980. Contract AC22-78ET10741. 116p. NTIS, PC A06/MF A01.

The Cu/ZnO methanol synthesis catalysts were investigated for (1) the role of additives such as alumina, ceria, and lanthana, (2) the effect of carbon dioxide in the H_2/CO synthesis gas, (3) the chemisorption of hydrogen and carbon monoxide on the catalysts, and (4) the chemical poisoning of the catalysts by sulfur- and chlorine-containing compounds. Maximum activity and selectivity were obtained with a binary catalyst having a composition of Cu/ZnO = 30/70 metal atomic percent and with a synthesis gas of H_2/CO/CO_2 = 70/28/2 volume percent in the absence of strongly reducing or strongly oxidizing chemical poisons. Both the binary and the ternary catalysts were fully characterized by scanning transmission electron microscopy (STEM), X-ray diffraction, electron spectroscopy, diffuse reflectance spectroscopy, and surface area-pore distribution measurements. Structural and morphologic information is presented in this report in detail for very active Cu/ZnO/Al_2O_3 catalysts prepared from acetates and for other catalysts in which the third component caused a loss of activity.

13568 **(ORNL/MIT—320) Ethanol production by Zymomonas mobilis in a tapered-bed bioreactor.** Sitchin, R.; Gubanc, P.F.; Tormo, J.V. Jr. (Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice). Feb 1981. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01.

The fermentation of glucose to ethanol by the bacterium Zymomonas mobilis was studied. A tapered bioreactor containing an anion exchange resin, to which bacteria were attached, was fluidized by feed solution at 35°C. Short residence times characteristic of the experimental tapered reactor were necessary to model various differential segments of a hypothetical large-scale reactor. A feed concentraton of 10% glucose as well as glucose/ethanol mixtures were studied. Ethanol production ranged from 29 g/liter-h for a feed containing 2% weight per volume glucose to 64 g/liter-h for a 10% glucose feed. Development of biomass concentration-measurement techniques was begun. Caustic stripping, DNA analysis,

and dehydrogenase determinations were attemped, but results were inconclusive.

13569 **(PB—80-197049) Federal agency compendium: federal agency and department alcohol fuels programs.** (National Alcohol Fuels Commission, Washington, DC (USA)). Jun 1980. 55p. NTIS, PC A04/MF A01.

The report contains a detailed description of all current Federal alcohol fuels programs and financial assistance.

13570 **(PB—80-197874) Use of ethanol from sugar molasses as a blending component in gasoline.** (Petroleum Conservation Research Association, New Delhi (India)). 1979. 20p. NTIS, PC A02/MF A01.

This paper analyzes the possibilities and the various issues involved in the use of ethyl alcohol from sugar molasses as a blend component in gasoline in India.

13571 **(PB—80-203839) Alcohol fuels tax incentives. A summary: alcohol fuels provisions of the Crude Oil Windfall Profit Tax Act.** (National Alcohol Fuels Commission, Washington, DC (USA)). Apr 1980. 14p. NTIS, PC A02/MF A01.

This report contains a description of the alcohol fuels tax provisions contained in the Windfall Profit Tax Act, the most significant piece of Federal Tax Law affecting alcohol fuels.

13572 **(PB—80-812431) Alcohol fuels. 1978-June, 1980 (citations from the NTIS Data Base). Report for 1978-Jun 80.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 256p. NTIS PC N01/MF N01.

The bibliography covers Federally-funded research on alcohol based fuels that may be used in the future as a fuel source. The citations cover synthesis, chemical analysis, performance testing, processing, pollution, economics, environmental effects, and feasibility. (This updated bibliography contains 245 citations, 110 of which are new entries to the previous edition.)

13573 **(PB—80-812449) Alcohol fuels. 1970-1978 (citations from the Engineering Index Data Base). Report for 1970-78.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 227p. NTIS PC N01/MF N01.

The cited reports from a worldwide literature survey, include such topics as blends, synthesis, processes used, properties, engine performance evaluations, economics, safety measures, pollution effects, and combustion studies. Also covered are the sources from which alcohol fuels can be obtained, such as coal, solid wastes, industry by-products, and agricultural wastes. (This updated bibliography contains 220 citations, none of which are new entries to the previous edition.)

13574 **(PB—80-812456) Alcohol fuels. 1970-June, 1980 (citations from the Engineering Index Data Base). Report for 1970-Jun 80.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 163p. NTIS PC N01/MF N01.

The cited reports from a worldwide literature survey discuss new technology in the field of alcohol fuels. The bibliography covers the different blends, synthesis, processes used, properties, engine performance evaluations, economics, safety measures, pollution effects, and combustion studies. The research also covers sources from which alcohol fuels can be obtained, such as coal, solid wastes, industrial by-products, and agricultural wastes. (This updated bibliography contains 156 citations, 21 of which are new entries to the previous edition.)

0904 Solid Waste And Wood Fuels

13575 **(PB—80-209125) Environmental and technological analysis of the use of surplus wood as an industrial fuel. Final report, September 1977-December 1978.** Hall, E.H.; Burch, J.E.; Eischen, M.E.; Hale, R.W. (Battelle Columbus Labs., OH (USA)). Jun 1980. 107p. NTIS, PC A06/MF A01.

The report examines the technology and the environmental aspects of the use of surplus wood as an industrial fuel. It includes a review of various wood-burning technologies and a listing of existing facilities. Information on operational problems obtained through site visits is summarized. Estimates are presented of the reduction of sulfur dioxide emissions achieved by burning wood instead of coal or oil. Industrial fuel requirements are compared with the quantities of unused wood residues available on both regional and national levels. Ecological impacts of wood residue utilization and non-technical barriers to the use of wood fuel are explored.

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 13813

1301 Resources And Availability

13576 **(EPRI-EM—1679) Simplified methodology for economic screening of potential low-head small-capacity hydroelectric sites. Final report, May 1979-August 1980.** Brown, H.M. (Tudor Engineering Co., San Francisco, CA (USA)). Jan 1981. 229p. NTIS, PC A11/MF A01.

A simplified methodology for economic screening of potential low-head, small-capacity sites is presented in the form of a manual which will permit a first level analysis to be made of a potential hydroelectric power site. Step-by-step procedures are described to assist personnel with a limited technical background to estimate the power and energy output and the project costs for a potential site, and to perform a preliminary economic analysis. Two procedures are described, one rapid and simplified and the other more detailed to provide for the variability inherent in hydroelectric site development. Background descriptions are provided to assist those unfamiliar with hydroelectric practice. The manual covers plant capacities ranging from 200 to 15,000 kilowatts and a head range of 6 to 200 feet.

13577 **(LBL—9628) Hydroelectric power in California.** Ingersoll, J.G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1979. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01.

The hydroelectric power potential of California was examined and the problems related to the development of that potential reviewed. The generating capacity of 173 existing conventional hydro power plants is 8500 MWe. Conventional hydroelectric power development is expected to add between 0.2 and 0.4 quads (20×10^9 to 40×10^9 kWh) per year to the current hydroelectric supply of 0.3 quads. The upper limit of 0.4 quads appears to be close to the maximum remaining-to-be-developed hydroelectric potential in the state, thus bringing the California total potential to 0.7 quads. It is anticipated that within the next 20 years at least half of that undeveloped conventional potential will be or can become cost-benefit favorable for development. The pumped storage potential of the state has an upper limit of 6.5 quads, all undeveloped. It is anticipated that development of the pumped storage potential of the state will follow simultaneous and parallel development of other renewable resources, notably wind. Relatively small development, less than 0.3 and even 0.15 quads, or 7000 and 3000 MWe respectively, of pumped storage associated with the water supply, and fossil and nuclear power generation probably will continue throughout the remainder of this century. The attendant water and land requirements for the full development of the 6.5 quads of the pumped storage potential, do not pose any strain on the natural resources of the state since they constitute only 1.0% of the annual rainfall and 0.1% of the land of California. Finally, hydroelectric development entails, in most cases, changes in the environment. Past experience, however, has proven that responsible study, planning, and execution of any hydroelectric project always leads to results beneficial to both nature and humanity. (LCL)

13578 **(ORNL/TM—7620) Environmental issues and site selection criteria for small hydropower projects in developing countries.** Cada, G.F.; Zadroga, F. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 55p. NTIS, PC A04/MF A01.

Small Hydropower Projects (SHPP), i.e., those with capacities of 1000 kW or less, have great potential for elevating the stand-

ard of living and contributing to the economic growth of isolated rural communities in developing countries. However, construction and operation of a SHPP can result in adverse environmental impacts that should be considered in the initial stages of site selection and development. Environmental concerns can be factored into a site selection process both at the prefeasibility and feasibility stages. The prefeasibility study is the process by which a large number of potential sites is reduced to a much smaller number of candidate sites based on coarse-grained engineering, socioeconomic, and environmental criteria. Although many of the factors determining the suitability of a given site at the prefeasibility stage involve basic engineering or economic questions (e.g., availability of water and demonstrated need for power), four fundamental environmental issues that should be addressed are discussed in this report. The feasibility study is the final stage of site selection, where a relatively small number of candidate SHPP sites are examined in greater detail and the best are selected for development. Potential environmental impacts of SHPP's are discussed, and a checklist of environmental data that should be collected in order to judge the significance of the projected impacts is provided. Finally, recommendations are made as to the necessary training and capabilities of the personnel involved in the site selection studies and the general procedures by which the studies may be conducted.

13579 **(PB—80-928207) Electric power for China's modernization: the hydroelectric option. Research paper.** (Central Intelligence Agency, Washington, DC (USA)). May 1980. 40p. NTIS PC E03/MF A01.

Shortages of electric power probably will restrain the development of China's economy throughout the 1980s. Such shortages have been a major factor in the recent slowdown of economic growth and probably will prolong the current period of economic readjustment. To help meet future power needs, the Chinese are seriously considering a massive program to construct hydroelectric power stations. China has the world's largest hydroelectric resources. Although the bulk of these resources is located in remote areas of west and southwest China, an estimated 145,000 to 220,000 MW of exploitable hydroelectric capacity can be transmitted to major industrial centers using China's existing technology. This is about three to five times China's total installed capacity (thermal and hydro) at yearend 1979. The success of China's hydroelectric program depends on a number of factors. Political stability over the next five- to 10-year period is essential a return to the internal instability and confused economic planning of the past would be disastrous. An adequate source of financing also is crucial to the success of the program. The electric power industry, moreover, will have to be given priority over most other industrial sectors for domestic capital and for access to long-term foreign loans.

13580 **Lifting hydro's potential.** Lihach, N.; Ferreira, A. *EPRI (Electric Power Research Institute) Journal ;* **5**: No. 10, 6-13(Dec 1980).

Electric utilities are taking another look at potential sites for hydroelectric installations, reevaluating sites that had been uneconomic to develop and those that can be renovated or expanded. Both large- and small-scale facilities now offer the advantages of free fuel, no air or thermal pollution, and no waste - making hydro an attractive way to increase utility capacity. The Electric Power Research Institute (EPRI) is participating in screening studies which evaluate the unique characteristics of specific sites and recommend technical improvements for better water control and a higher output. Pumped-hydro facilities are increasing, with new attention going to underground storage as new aboveground sites become harder to find. The institutional hurdles of licensing and regulation, interference with recreational and shoreline activities, down-stream water temperature changes, fish migration, and insurance are often in conflict. EPRI's screening program includes a simplified cost/benefit analysis and a site characterization, which utilities can use for their evaluation. Future research will explore a new financing arrangement that will lower front-end costs. (DCK)

1302 Site Geology And Meteorology

REFER ALSO TO CITATION(S) 13585

13581 **(PB—80-170806) Development of small hydroelectric projects in Appalachia. Final report.** Warren, J.L. (Research Triangle Inst., Research Triangle Park, NC (USA). Applied Ecology Dept.). Dec 1979. 182p. NTIS, PC A09/MF A01.

The project identified small hydroelectric sites in the Appalachian counties of North Carolina with development potential. From this list, three sites, North Fork Reservoir Dam owned by the City of Asheville, the Town of Highlands Dam, and Capitola Dam were chosen for further detailed feasibility analyses. Based on (1) detailed inspection of the sites, (2) analysis of construction costs, and (3) identification of generic problems associated with small hydro, a cost-effectiveness analysis of the financial feasibility of each site will be prepared. As part of this task, the effects of power generation on existing operations at each site and the potential power customers will be identified.

1303 Plant Design And Operation

13582 **(DOE/ID/01818—T1(Vol.1)) Canton hydroelectric project: feasibility study. Final report.** (Development and Resources Corp., Sacramento, CA (USA)). Jun 1979. Contract FC07-78ID01818. 161p. NTIS, PC A08/MF A01.

The Canton Hydroelectric Project study was undertaken to determine the feasibility of redeveloping hydroelectric power generation facilities at the Upper and Lower Dams on the Farmington River at Collinsville, CT. The integrity of the existing dams and power plants was investigated and found to be generally adequate. The intake channels, powerhouses and tailraces will require refurbishing but no major repairs. The Lower Dam will require some repair to correct surface deterioration conditions. New flashboard installations are contemplated for both the dams. Energy production operational studies were performed on 25 generating unit alternatives for the two sites. Detailed cost estimates were prepared for seven Upper and five Lower site alternatives, and a detailed economic analysis of ten project alternatives was performed. The economic analysis included 3 power marketing options and the future escalation of the value of energy. The conclusions of this study were: the project is economically feasible on a 40-y life cycle basis; short-term financing, bond payment adjustments, or other special financial arrangements will be needed to provide for the negative cash flow during the early years of operation; and the Town of Canton should further pursue the power marketing and financing aspects of the project. (LCL)

13583 **(DOE/ID/01818—T1(Vol.2)) Canton hydroelectric project: feasibility study. Final report, appendices.** (Development and Resources Corp., Sacramento, CA (USA)). May 1979. Contract FC07-78ID01818. 339p. NTIS, PC A15/MF A01.

These appendices contain legal, environmental, regulatory, technical and economic information used in evaluating the feasibility of redeveloping the hydroelectric power generating facilities at the Upper and Lower Dams of the Farmington River at Collinsville, CT. (LCL)

13584 **(DOE/RA/23210—T1) Sawmill hydrostation redevelopment. First annual report.** (Brown Co., Berlin, NH (USA). Engineering Dept.). Nov 1980. Contract FC07-79RA23210. 56p. NTIS, PC A04/MF A01.

Progress during the period from July 1979 to July 1980 in the redevelopment of the Sawmill Dam in New Hampshire as a run-of-river hydroelectric generating station is reported. This project should demonstrate the technical and economic feasibility of retrofitting existing dams for low-head hydro power plants. The topics discussed include licensing and permits, project planning, environmental concerns, engineering and design, safety, materials and equipment procurement, publicity, and construction status. (LCL)

1304 Regulations And Licensing

13585 (PB—80-207772) Small hydroelectric project manual for Appalachian New York. (New York State Energy Research and Development Authority, Albany (USA)). Mar 1980. 259p. NTIS, PC A12/MF A01.

A major New York State energy goal is reducing dependence on expensive, imported oil. Throughout the Appalachian Region of New York State there are existing dam sites that have potential for development as small/low-head hydroelectric generating plants. These hydroelectric sites include those with abandoned generating facilities as well as those which were constructed for purposes such as flood control, navigation, and water storage. To encourage and assist efforts to develop these sites, this manual has been prepared to help identify those sites that have potential for hydroelectric power generation and to provide guidelines for the performance of preliminary feasibility assessments of the sites. The manual guidelines will assist municipal officials, planners, and others who do not have hydroelectrical engineering backgrounds in estimating the generating capacities and approximate power generating costs of small hydroelectric power installations. Legal, regulatory, and institutional issues affecting small hydroelectric power facilities have also been identified, and discussions of various approaches to these problems are included.

1305 Economics And Management

REFER ALSO TO CITATION(S) 13576, 13581, 13584

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 13578, 14888

13586 (PB—80-200090) Libby Dam Project: an ex-post facto analysis of selected environmental impacts, mitigation commitments, recreation usage and hydroelectric power production. Final report. Ciliberti, V.A. Jr. (Montana State Univ., Bozeman (USA). Water Resources Research Center). Apr 1980. Contract DI-14-34-0001-8028. 151p. NTIS, PC A08/MF A01.

Water impoundment projects generally impact the river below the dam. Frequently the construction contract provides for mitigation of adverse impacts. The Libby Project, authorized primarily for hydro-electric power generation and flood control and to provide navigation and recreation as secondary benefits, caused the inundation of a big-game winter range, the relocation of a railroad and a highway in addition to damming a river. The Army Corps of Engineers in cooperation with the Montana Department of Fish and Game and others engaged in a number of wildlife mitigation projects.

14 SOLAR ENERGY

13587 (EPRI-AP—1713-SR) Electric utility solar energy activities: 1980 survey. Wentworth, M.C. (Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1980. 283p. NTIS, PC A13/MF A01.

The results of a survey to determine the scope of solar energy projects sponsored by electric utilities in the United States are presented. Brief descriptions of 839 projects being conducted by 236 utility companies are given. Also included are an index of projects by category, a statistical summary, a list of participating utilities with information contacts and addresses, a list of utilities with projects designated by category, a list of utilities organized by state, a list of available reports on utility-sponsored projects, and a list of projects having multiple utility participants. Project categories include solar heating and cooling of buildings, wind energy conversion, solar-thermal electric power, photovoltaics, biomass conversion, process heat, and ocean energy conversion. (WHK)

1401 Resources And Availability

13588 (PB—80-180417) Comparison of estimated and observed values for solar radiation at the surface of the African continent. Technical memo. Nimira, J.K. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Jan 1980. 51p. NTIS, PC A04/MF A01.

Solar radiation fluxes at the surface of the African continent were estimated by three methods. The methods used cloud data derived from satellite measurements, observed sunshine hour data, and data on several other parameters measured at 57 ground stations throughout Africa. The estimated values were then compared with actual observed global solar radiation values from 10 selected stations. The percentage deviation between estimated and observed values was generally less than plus or minus 15%.

13589 (SOLAR/0010—81/02) Environmental data for sites in the National Solar Data Network. (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). Feb 1981. Contract AC01-79CS30027. 237p. NTIS, PC A11/MF A01.

Available meteorological data for reporting sites in National Solar Data Network are presented as follows: the insolation table presents the total, diffuse, direct, maximum, and extra-terrestrial radiation for the solar site; the temperature table gives the average, daytime, nighttime, maximum, minimum, and inlet-water temperatures for the solar site. Wind speed and direction and relative humidity values for day and night are presented also. (MHR)

13590 Solar irradiance availability in mountainous terrain. Dirmhirn, I. (Utah State Univ, Logan). *American Society of Mechanical Engineers, [Paper] ;* No. 80-C2/Sol-26, 1-6(1980).

Solar radiation availability in mountains is more uniform than in lower elevations. While direct solar irradiance can be calculated, diffuse is dependent on so many parameters that more intensive work is necessary. Hence, this paper emphasizes diffuse irradiance as dependent on elevation, cloudiness (or duration of sunshine), and albedo of the ground. The variation of irradiance by the topography of the terrain, as calculated from mathematical models, is shown in examples. 7 refs.

13591 Simple methodology for generating solar percentage graphs based on actual winters. Hodges, L.; Block, D.A.; Ward, W.O. (Iowa State Univ, Ames). pp 124-127 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Easy-to-use solar percentage graphs using real meteorological data have been generated for the use of passive designers in Iowa. To use the graphs the designer must estimate four variables and form ratios of these quantities. These were generated by a simple heat balance method carried out separately for each night and day; this method and some of its uses are described. 2 refs.

13592 Architectural climatology charting: characterizing the micro-climate of the site. Robbins, C.L. (Fla AandM Univ, Tallahassee). pp 255-258 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

In order to accurately establish the micro-climatic parameters of a given site it is necessary to first establish the regional context against which the site can be compared. Computer simulation has established 87 distinct climate regions for the United States (including Alaska and Hawaii). Within each of these regions there can be an almost infinite number of micro-climatic variations. 3 refs.

13593 **Presentation of local solar and climatological design data--an example.** Abrams, D.W. (South Sol Energy Cent, Atlanta, Ga). pp 263-267 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The preparation of a locally specific climatological design reference is described. A booklet for Atlanta, Georgia is utilized as a model to facilitate development of similar documents for other locations. A suggested table of contents, a generalized format and a list and description of data sources are included. 1 ref.

13594 **Assessment of the probability of extended periods with low solar radiation.** McCollom, W.E.; Decker, W.L. (Univ of Mo, Columbia). pp 273-277 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A method has been developed which uses the Poisson distribution for providing estimates of the probability of low solar radiation amounts for selected durations during different parts of the heating season. This technique does not identify the meteorological conditions effecting solar radiation. 2 refs.

13595 **Research on climate design for home builders: brief summary of quantification results.** Watson, D.; Harrington, K. (Yale Sch of Archit, New Haven, Conn). pp 636-639 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The research reported in this paper was undertaken with the intent of reviewing the effectiveness of these climate design elements in different U.S. climates. Computer simulations of twenty-four climate design elements were executed for twenty climatically representative test cities. The results are tabulated as percent improvements over the performance of a base house in each city and their resulting rank order based on each strategy's effectiveness in each city. 3 refs.

1403 Economics

REFER ALSO TO CITATION(S) 13627, 13628, 13629, 13664, 13672, 13691, 13700, 13719, 13734, 13744

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 13392, 13613, 13625, 13673, 13679

13596 **(SAND—80-7081) Access to solar energy: the problem and its current status.** Eisenstadt, M. (Eisenstadt (Mel) and Associates, Inc., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 48p. NTIS, PC A03/MF A01.

The problems of providing access to sunshine for solar-energy systems has been seriously addressed in this country during the past five years. Several legal methods for providing such access have been suggested to date. These are easements, restrictive covenants, subdivision statutes and ordinances, nuisance law, permit systems, state statutes creating solar access rights, and zoning. Each has certain advantages and disadvantages which are analyzed. Some methods protect solar access for potential solar-collector sites as well as existing collectors, while others are usable only for collectors that are already installed. The different states, counties, and municipalities that use the various methods are identified. While each of the methods has its problems, zoning appears to be emerging as th most popular. For this reason, zoning for solar access is discussed in some detail. It is necessary to specifically define the extent of the solar access provided by a zoning ordinance. At present, three different means are used to do so. These are hypothetical walls, solar envelopes, and height-and-setback restrictions. All three are shown to be mathematically equivalent. Suggestions are made as to which is best for both high-density and low-density areas. Recommendations are made for further work that is needed in the area of zoning for solar access. 97 references.

13597 **Dealing with the government: an examination of the legislative barriers and incentives to passive solar design.** Dalton, S.H. (Ehrenkrantz Group, New York, NY). pp 89-92 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The relationship of passive solar energy systems to tax incentives, building codes, and energy codes is clarified. An examination is made to determine the extent to which passive solar energy systems were included in state solar legislation and the National Energy Tax Act of 1978. 3 refs.

13598 **Successful strategies for renewable energy legislation in the states.** Stangl, D. (Energy Inform Inc, Omaha, Nebr). pp 93-96 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper relates experiences in working with renewable energy legislation in the State of Nebraska, and offers guidelines and suggestions for researching, drafting, and lobbying renewable energy legislation in state legislatures.

13599 **Passive solar legislative primer: a case study of michigan's solar tax and subsidy experience.** Hendrickson, R. (StarPak Sol Syst, Novi, Mich). pp 97-100 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

It is suggested that State Government incentives for passive solar development are more readily adopted and administered than at the Federal level. This paper presents a case history of the reconciliation between passive solar advocacy and State legislative/regulatory realities in Michigan. 8 refs.

13600 **Solar energy subdivision: an assessment of selected institutional barriers to solar energy in urban areas.** Shillington, T.H. (Univ of Manit, Winnipeg). pp 109-113 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A hypothetical passive solar energy subdivision is used to clarify the institutional implications of solar housing in Winnipeg, Manitoba. The concept of a "sunscape", which depicts the scope of solar access needs for a solar home, is derived and used as a design tool to determine appropriate siting of solar homes within the subdivision.

1405 Solar Energy Conversion

13601 **(BMFT-FB-T—80-060) Development of single-crystal CdTe solar cells for terrestrial application in optical concentrators. Final report.** Jaeger, H.; Fuessl, B.; Seipp, E.; Thiel, R. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Dec 1980. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01.

It was the aim of the study to find optimum preparative conditions for CdTe solar cells and to investigate their utility when used in concentrated light. Semitransparent Au-Schottky barrier contacts and p-type ZnTe layers were evaporated on n-type CdTe wafers to form photovoltaic structures. CdS and indium-tin-oxide (ITO) layers, both of n-type, were deposited on p-CdTe wafers. Schottky diodes on n-CdTe exhibit a high photocurrent. ZnTe was

found to be of high resistivity; however, it was possible to deposit low-resistivity transparent ZnTe layers. First solar cell samples of n-CdS and ITO on p-CdTe yielded 3% cell efficiency. The ohmic contacts on p-type CdTe are the critical element in this case. The solar cells of p-CdTe/n-CdS (or ITO) seem to be the better approach. Concentrator applications will presumably not be possible because the contact resistances are not low enough.

13602 **(COO—2982-66) Conversion of cellulosic wastes to liquid hydrocarbon fuels. Progress report, January-February 1981.** Kuester, J.L. (Arizona State Univ., Tempe (USA)). 1981. Contract AS02-76CS40202. 5p. NTIS, PC A02/MF A01.

The following materials were processed thru gasification: sugarcane bagasse, smooth sumac, coralberry, wild bergamot, pokeweed, cornstarch, Portugese oak cork and hog fuel. A data summary is given. The high H_2/CO ratio at low temperature for pokeweed is of significance ($>T$, $>H_2$). Also the high olefin content of Portugese oak cork (commercial cork) is of major interest. The most promising feedstock to date with regard to synthesis gas composition has been guayule cork. A comparison of data for the two cork materials is given. A detailed breakdown for corn starch is given revealing an exceptionally high methane content (35.50 mole %). (MHR)

13603 **(COO—3004-3) Thin films of InP for photovoltaic energy conversion. Third quarterly technical progress report, December 29, 1979-March 28, 1980.** Manasevit, H.M.; Ruth, R.P.; Moudy, L.A.; Yang, J.J.J.; Johnson, R.E. (Rockwell International Corp., Anaheim, CA (USA). Electronic Devices Div.). Apr 1980. Contract AC02-79ET23004. 39p. NTIS, PC A03/MF A01.

A research study is being conducted for the purpose of developing a low-cost high-efficiency thin-film InP heterojunction solar cell based on InP films grown by the metalorganic chemical vapor deposition (MO-CVD) process on suitable substrates. Heterostructure devices of CdS/InP (and possibly indium tin oxide/InP) are to be prepared at Stanford University under subcontract, using the MO-CVD InP films grown at Rockwell. The work of the third quarter of the program is summarized. Experiments continued on evaluation of GaP as an intermediate layer material for subsequent growth of InP films on various substrate materials, and Cd (obtained from dimethylcadmium) was evaluated as a p-type dopant (an alternative to Zn obtained from diethylzinc) for InP films made by the MO-CVD process. A preliminary x-ray diffraction analysis was conducted of the crystallographic structure of the vacuum-deposited CdS films prepared at Stanford as part of the process of fabricating CdS/InP heterojunction solar cells. A group of CdS/InP heterostructure cells involving vacuum-deposited CdS and p-type epitaxial InP films grown by MO-CVD was prepared and evaluated. High J_0 values and low fill factors were observed in all of the cells, resulting in AM1.5 efficiencies in the 2 to 5 percent range. (WHK)

13604 **(DOE/ET/20055—T3(Exec.Summ.)) Advanced system demonstration for utilization of biomass as an energy source.** (Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering). Sep 1980. Contract AC-06-77-ET20055. 49p. NTIS, PC A03/MF A01.

The conclusions of a detailed assessment of the impacts on the natural and human environment expected to result from the construction, operation, and fueling of the proposed wood-fuel power plants are summarized. The environmental impacts of alternative supplementary fuels are discussed. (MHR)

13605 **(DOE/ET/20055—T5) Advanced system demonstration for utilization of biomass as an energy source.** (Wood Energy Inst., Camden, ME (USA)). Oct 1980. Contract AC06-77ET20055. 215p. NTIS, PC A10/MF A01.

The results of a 20 month study to explore the technical and economic feasibility of fuelwood utilization to operate a 50 megawatt energy conversion facility are described. The availability of biomass as a fuel source, the methods of harvesting and collecting the fuelstock, the costs of providing adequate fuel to the plant, and other requirements for fueling the proposed conversion facility are investigated. (MHR)

13606 **(DOE/JPL—1012-50) Correction for spectral mismatch effects on the calibration of a solar cell when using a solar simulator.** Seaman, C.H. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Jan 1981. Contract AI01-76ET20356. 8p. NTIS, PC A02/MF A01.

A general expression has been derived to enable calculation of the calibration error resulting from simulator-solar AMX spectral mismatch and from reference cell-test cell spectral mismatch. The information required includes the relative spectral response of the reference cell, the relative spectral response of the cell under test, and the relative spectral irradiance of the simulator (over the spectral range defined by cell response). The spectral irradiance of the solar AMX is assumed to be known.

13607 **(DOE/JPL/955506—80/2) Ion-plating of solar cell arrays encapsulation task: LSA Project 32. Second quarterly progress report, April-June 1980.** Conley, W.R. (Illinois Tool Works, Inc., Elgin (USA). Venture Group). Feb 1981. Contract NAS-7-100-955506. 15p. NTIS, PC A02/MF A01.

Functional solar cells were produced having ion-plated metallizations on both front and back surfaces. These cells consisted of 3.25 diameter n on p type silicon wafers with silver front and back contacts. The performance of these cells, although encouraging, was less than that of cells currently available on the photovoltaic market. Attempts were also made to produce a cell having nonnoble (inexpensive) metallizations, utilizing aluminum, copper and 302 stainless steel. These attempts proved less successful than those utilizing silver.

13608 **(DOE/JPL/955843—81/1) Large-area sheet task: advanced dendritic web growth development. Quarterly report, October 23-December 31, 1980.** Duncan, C.S.; Seidensticker, R.G.; McHugh, J.P.; Hopkins, R.H.; Meier, D.; Frantti, E.; Schruben, J. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 31 Jan 1981. Contract NAS-7-100-955843. 49p. NTIS, PC A03/MF A01.

Silicon dendritic web is a single crystal ribbon form of silicon capable of fabrication into solar cells with AM1 conversion efficiency in excess of 15%. Progress on a study to demonstrate the technology readiness of the web process to meet the national goals for low cost photovoltaic power is reported. Several refinements were introduced into the sensing and control equipment for melt replenishment during web growth and also several areas were identified for cost reduction in the components of the prototype automated web growth furnace. A new circuit has been designed, assembled and tested to eliminate the sensitivity of the detector signal to the intensity of the reflected laser beam used to measure melt level. Noise due to vibrations on the silicon melt surface has also been eliminated. A new variable speed motor has been identified for the silicon feeder. Pellet feeding will be accomplished at a rate programmed to match exactly the silicon removed by web growth. A system to program the initiation of web growth automatically has been designed and first tests initiated. This should eventually result in reduced labor content and improved process reproducibility. Potential cost reductions in the furnace chamber and storage reel have been identified. A furnace controller providing a functional capability similar to our experimental hardware but at about one third the cost will shortly be tested.

13609 **(DOE/R5/10126—T1) Wood fuel technologies and group-oriented Timber Stand Improvement Program: model for waste wood utilization and resource renewal.** (Barry County Board of Commissioners, Hastings, MI (USA)). 1980. Contract FG02-79R510126. 35p. NTIS, PC A03/MF A01.

Progress is reported on the following: educating and assisting landowners in the most efficient and profitable use of wood resources; developing local timber resources as energy alternatives by representing collective interests to Consumers Power, the woodchip industry, firewood retailers, country residents, and woodlot owners; and providing public information on the economics and methods of wood heat as a supplemental energy source. (MHR)

13610 **Biomass handbook for the biomass conversion demonstration program.** Smith, K.D.; Vann, L.G. Jr; Fong, D. Sacramento, CA; California Energy Commission (1980). 103p. (NP—25299).

The California Energy Commission is charged with the responsibility of implementing the State Agricultural and Forestry Residue Utilization Act of 1979. The preparation of a handbook which serves as a primer to the utilization of biomass residues for energy conversion is a result of this responsibility. The purpose of the handbook is to encourage biomass utilization by educating both professional energy engineers and potential energy users in the agricultural and industrial sectors. The handbook briefly describes the factors that must be considered in a preliminary evaluation of a biomass energy system. This includes discussion of the biomass resource base, residue collection and storage, potential biomass energy recovery, conversion technologies (direct combustion, gasification, and methane fermentation), pollution control measures, economics, and regulatory requirements.

13611 **(LA-UR—81-549) Bio-energy: a taxonomy of land use impacts.** Parsons, V.K.B. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 20p. (CONF-810315—4). NTIS, PC A02/MF A01.

From 8. energy technology conference and exposition; Washington, DC, USA (9 Mar 1981).

Potential land use impacts are identified from each of the four major bio-energy technology classes: anaerobic digestion, fermentation, gasification, and direct combustion. Each technology class is discussed with respect to each of the five major land use categories in the US: production of food and fiber; energy, industry, and commerce; housing and community; transportation and recreation, and open space.

13612 **(LBL-PUB—3013) Process evaluation unit (PEU) operating manual.** Figueroa, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jan 1981. Contract W-7405-ENG-48;AC06-76RL01830. 14p. NTIS, PC A02/MF A01.

The operating manual described was written for the Process Evaluation Unit (PEU). The purpose of the PEU is to efficiently [illegible] new biomass liquefaction process concepts in a continuous fashion on a bench scale. The PEU consists of the following: (1) [illegible]ned, recirculating feed system; (2) mass-controlled gas feed [illegible]m; (3) tubular reactor; (4) product collection system; (5) off-automatic analysis; and (6) central data logger and controller.

13613 **(PB—80-182066) Preliminary characterization of emissions from wood-fired residential combustion equipment.** DeAngelis, D.G.; Ruffin, D.S.; Reznik, R.B. (Monsanto Research Corp., Dayton, OH (USA)). Mar 1980. 159p. NTIS, PC A08/MF A01.

This report describes a study conducted to quantify criteria pollutants and characterize other atmospheric emissions from wood-fired residential combustion equipment. Flue gases were sampled from a zero clearance fireplace and two air-tight cast iron stoves (baffled and nonbaffled design). Four wood types were tested, oak-seasoned and green- and pine-seasoned and green. Samples were analyzed for particulates, condensable organics, nitrogen oxides, carbon monoxide, sulfur oxides, organic species, and individual elements.

13614 **(PB—80-195829) Chemicals from western hardwoods and agricultural residues. Semi-annual report.** (Washington Univ., Seattle (USA). Coll. of Forest Resources). 15 Apr 1980. 131p. NTIS, PC A07/MF A01.

This report describes methods of delignification and characterization of by-product lignins and conversion processes of biomass components to chemical feedstocks. Results of kinetic and model studies are reported. A better understanding of the organosolv delignification process was obtained. Exploratory work on organosolv delignification using ammonium sulfide as a catalyst has led to the discovery of an exceptionally selective delignification system, resulting in near-quantitative recovery of the polysaccharides in the pulp. For both cottonwood and bagasse, the lignin-free pulp yields exceed by 11 to 12 percent the yields of conventional kraft and soda pulps at low kappa levels. Furthermore, the tensile strength of the pulp obtained from cottonwood was higher after beating than that of the corresponding kraft pulp. The ammonium sulfide-catalyzed organosolv process has substantial interest for industrial application. This method allows for the facile recovery of both ethanol and ammonium sulfide by simple distillation. Simultaneously, the dissolved lignin precipitates in a filterable form. The average molecular weight of this lignin appears to be lower than those of organosolv lignins previously isolated. Thus, lignin obtainable from this process has promising feedstock properties and is presently being characterized. Average molecular weights for a number of organosolv lignins were determined. Results of work in the following areas are presented: the potential of lignins in polymeric applications; microwave degradation of biomass and lignins; and hydrocracking in tetralin.

13615 **(PB—80-810807) Biomass energy production. 1975-April, 1980 (citations from the International Aerospace Abstracts Data Base). Report for 1975-Apr 80.** Moore, P.W. (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jun 1980. 58p. NTIS PC N01/MF N01.

These citations from the international literature describe the production and/or utilization of most forms of biomass as a source of energy, fuel, food, and chemical intermediates or feedstocks. Biomass conversion by incineration, gasification, pyrolysis, hydrolysis, anaerobic digestion, or fermentation, as well as by catalytic, photosynthetic, chemosynthetic, and bio-electrochemical means are among the conversion processes considered. Discussions include biomass plantation and material productivity, transportation and equipment requirements, environmental effects, comparisons of means and efficiencies of utilization and conversion, assessments of limitations, and evaluations of economic potential. (Contains 210 abstracts)

13616 **(PNL-SA—8602) Chemical comparisons of liquid fuel produced by thermochemical liquefaction of various biomass materials.** Russell, J.A.; Molton, P.M.; Landsman, S.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1980. Contract AC06-76RL01830. 17p. (CONF-801210—22). NTIS, PC A02/MF A01.

From 3. Miami international conference on alternative energy sources; Miami Beach, FL, USA (15 Dec 1980).

Liquefaction of biomass in aqueous alkali at temperatures up to 350°C is an effective way to convert solid wastes into liquid fuels. The liqefaction oils of several forms of biomass differing in proportions of cellulose, hemi-cellulose, lignin, protein, and minerals were studied and their chemical composition compared. It was that the proportions of chemical components varied considerably depending on the type of biomass liquefied. However, all the oils, even those produced from cellulose, had similar chemical characteristics due to the presence of significant quantities of phenols. These phenols are at least partially responsible for the corrosivity and viscosity commonly associated with biomass oils. The differences in chemical component distribution in the various biomass oils might successfully be exploited if the oil is to be used as a chemical feedstock. If the oil is to be used as a fuel, however, then reaction conditions will be a more important consideration than the source of biomass.

13617 **(PNL-SA—8603) Thermal degradation of cellulose in alkali.** Miller, R.K.; Molton, P.M.; Russell, J.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1980. Contract AC06-76RL01830. 12p. (CONF-801210—21). NTIS, PC A02/MF A01.

From 3. Miami international conference on alternative energy sources; Miami Beach, FL, USA (15 Dec 1980).

Biomass in an alkaline aqueous slurry can be liquefied by heat and pressure. Understanding the mechanisms of biomass liquefaction to improve the efficiency of converting biomass to useful products, particularly chemicals and synthetic fuels is discussed. To study the chemical mechanisms of this process, pure cellulose, the main component of biomass, was liquefied. The 78 cellulose liquefaction products that were identified by gas chromatography/mass spectrometry include polyols, furans, ketones, hydrocarbons, and aromatic compounds. Polyols may be formed by hydrogenolytic cleavage. Furans an cyclic ketones may be cyclization products of dicarbonyl intermediates formed by aldol condensation of small initial degradation products such as acetone and acrolein. Several of

these small carbonyl compounds were used as model compounds to test proposed mechanisms for furans and cyclic ketones and obtained products supporting five of the mechanisms. For the best case of 26 cellulose liquefaction experiments, 34% of the initial mass of the cellulose was converted to acetone-soluble oil with a heat of combustion of 14,000 Btu/lb.

13618 **(SERI/PR—8058-2-T2) Advanced photovoltaic concentrator cells. Quarterly technical progress report, September 1, 1980-November 30, 1980.** Yang, H.T.; Yang, J.J.J.; Zehr, S.W. (Rockwell International Corp., Thousand Oaks, CA (USA)). Dec 1980. Contract AC02-77CH00178. 54p. NTIS, PC A04/MF A01.

It is the objective of this project to demonstrate the technical feasibility of producing monolithic stacked multibandgap solar cells having 30% conversion efficiency at 30°C and 25% conversion efficiency at 150°C under 500 to 1000 SUNs AM2 illumination. To meet this objective, the following tasks will be performed: 1) grow and optimize single junction AlGaAs cells having bandgaps of 1.6 eV and 1.7 eV and AlGaSb cells having bandgaps of 0.95 eV and 1.1 eV; 2) develop techniques for joining these optimized single junction cells by means of non-lattice matched intercell ohmic contacts having sufficient optical transparency combined with low electrical and thermal resistance to meet the overall performance objective; and 3) characterize performance of the individual cells and stacked combinations using appropriate light and dark I-V and spectral response measurements over the operating temperature range of 30 to 200°C and for illumination levels of 1 to 1000 SUNs AM2. Progress is reported. (WHK)

13619 **(SERI/TP—621-954) Biotechnological research and development for biomass conversion to chemicals and fuels.** Villet, R. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1980. Contract AC02-77CH00178. 22p. (CONF-800892—1). NTIS, PC A02/MF A01.

From Society for Industrial Microbiology annual meeting; Flagstaff, AZ, USA (10 Aug 1980).

It is likely that a growing need to produce chemicals and fuels from renewable resources will stimulate the development of biotechnology as a commerical enterprise of considerable potential. The purpose of the analysis and the development structure that could lead to establishing this new technology are presented. Two general goals are recommended: (i) in the near term, to revive the older fermentation industry and, by the addition of sophisticated technology, to make it competitive; (ii) in the longer term, to develop a new biotechnology largely based on lignocellulose. Specific research projects are outlined in these two areas and also for the following: microbial formation of hydrocarbons; methane from anaerobic digestion; lignin; methanol. For cellulose conversion to ethanol the relative merits of using added cellulases or, alternatively, direct fermentation with anaerobic thermophiles, are discussed. In selecting suitable feedstocks for biotechnological processes there is a need to use a production-extraction-conversion system as a basis for evaluation. An effective research workforce for developing biotechnology must be pluridisciplinary. The strategy adopted at the Solar Energy Research Institute is to design the Biotechnology Branch as an integrated set of three Groups: Biochemistry and Molecular Genetics; Microbiology; Chemical and Biochemical Engineering.

13620 **(TELIC—80-3) Cadmium sulfide/copper sulfide heterojunction cell research by sputter deposition. Quarterly technical progress report, September 2-November 30, 1980.** Thornton, J.A.; Anderson, W.W.; Meakin, J.D. (TELIC Corp., Santa Monica, CA (USA)). 15 Dec 1980. Contract AC02-77CH00178. 77p. NTIS, PC A05/MF A01.

Photoluminescence measurements of sputter-deposited CdS films have been made. In a first series of tests thin films of both doped and undoped CdS, deposited under reactive sputtering conditions typical of those used in previous cell fabrication, were found to be void of any photoluminescence emission in the visible spectrum. Subsequent tests of thicker films deposited under various conditions have shown emission from the undoped, but not from the doped, material. A post-deposition treatment process, where CdS films are cooled following deposition in a flux of sputtered Cd, has proven to be the most effective method examined for producing off-stoichiometric coatings with low resistivities ($< 100\ \Omega$-cm). The treated films are found to exhibit a photoluminescence emission. The modified apparatus with the vacuum interlock, that was assembled during the previous program, has permitted more controlled studies to be made on the influence of cathode and wall conditioning in the Cu_2S reactive sputtering process. Experiments are reported which show that the conditioning times for achieving consistent Cu_2S coatings are considerably longer than had previously been expected. The deposition of Cu_2S coatings with consistent properties has been achieved, and hybrid cells have been fabricated with sputtered Cu_2S deposited onto evaporated CdS supplied by IEC. A first series of cells have yielded J/sub sc/ $\sim$ 13 mA/cm^2, V/sub oc/ = 0.46 V, FF = 0.46, and eta = 2.7% after heat treatment at $\sim$ 150°C in Ar & H_2. These results, though preliminary, indicate that optimization of the composition and thickness of the sputtered Cu_2S should yield cells with efficiencies equivalent to those obtained with conventional ion exchange processing methods.

13621 **Investigation of photoelectrochemical corrosion of semiconductors. 1.** Frese, K.W. Jr.; Madou, M.J.; Morrison, S.R. (SRI International, Menlo Park, CA). *Journal of Physical Chemistry, The ;* **84**: No. 24, 3172-3178(27 Nov 1980).

Experimental results of photoinduced corrosion of n-GaAs are reported, and models to account for the behavior both in this material and in other semiconductors are developed. Specifically the role of defects (dislocations in particular) and of light intensity are discussed. Experimentally it is shown that the presence of dislocations on GaAs leads to much greater sensitivity to photocorrosion. It is shown theoretically that at the points where dislocations emerge at the surface there is a more negative microscopic decomposition potential, and corrosive attack at these points leading to highly reactive surface steps, will account for the increased sensitivity. Experimentally it is shown that the percent stabilization offered by reducing agents in solution decreases with increasing light intensity. Theoretically it is shown that the decrease can be explained if the hole capture leading to corrosion is second order in hole density and if the hole capture by the reducing agent is first order in the hole density. Such a behavior would be consistent with the need for the capture of two holes to eliminate one bond.

13622 **Spray pyrolysis of $CuInSe_2$ thin films.** Gorska, M.; Beaulieu, R.; Loferski, J.J.; Roessler, B.; Beall, J. (Brown Univ., Providence, RI). *Solar Energy Materials ;* **2**: No. 3, 343-347(Apr 1980).

The structural, electrical and optical properties of thin films of $CuInSe_2$ prepared by spray pyrolysis are described. The films were of the sphalerite or chalcopyrite structure, depending on the substrate temperature. Some effects of post-deposition heat-treatment are also presented.

13623 **Industrial chemicals and chemical feedstocks from wood pulping wastewaters.** Compere, A.L.; Griffith, W.L. (Oak Ridge National Lab., TN). *Tappi ;* **63**: No. 2, 101-104(Feb 1980).

A number of industrial chemicals and chemical feedstocks can be made from wood pulping wastewaters, including lactic acid and acrylic acid feedstocks, neutral solvents having wide industrial use (e.g., butanol, isopropanol, and ethanol), and Krebs cycle acids. The types of wastewaters and conditions required to produce these chemicals are reviewed.

13624 **Overview of thick-film technology as applied to solar cells.** Firor, K.; Hogan, S. (Sol Energy Res Inst, Golden, Colo). pp 210-214 of Proceedings of the electron components conference. Piscataway, NJ; IEEE (1980).

From Electronic component conference; San Francisco, CA, USA (28 Apr 1980).

The paper discusses a screen-printing technique as an alternative to more expensive, high-vacuum techniques in several of the production steps during the manufacture of silicon solar cells. Under investigation are the possibilities of non-noble metal contacts and protective and antireflective coatings applied to solar cells by the use of screen printing. 12 refs.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 13587, 13606, 14094

13625 (DOE/ER—0087) Design requirements for orbit maintenance of SPS elements. (Argonne National Lab., IL (USA)). Nov 1980. Contract W-31-109-ENG-38. 70p. NTIS, PC A04/MF A01.

The objective of this study is to identify the design and operational requirements that will be imposed by the need to avoid unplanned reentry of SPS elements. The LEO Staging Base, Electric Orbit Transfer Vehicle, the LEO Construction Base, and SPS Self-Power Module are the SPS elements selected for this analysis. The orbit decay rates and attitude control/orbit maintenance propellant requirements for nominal and worst case conditions are defined. The sequence of events that could cause unplanned reentry are defined. The design and operational requirements that will be used to prevent the various elements from deorbiting are defined.

13626 (DOE/ET/20279—117) Materials, Processes and Testing Laboratory. Technical progress report, July-October 1980. Forman, S.E.; Themelis, M.P. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Jan 1981. Contract AC02-76ET20279. 31p. NTIS, PC A03/MF A01.

The US Department of Energy has set a 20-year lifetime goal for terrestrial photovoltaic modules. In its capacity as a Residential Photovoltaic Field Test and Applications Center, Massachusetts Institute of Technology Lincoln Laboratory has established various experimental test sites, ranging in size from 0.1 to 100 kW of peak power, throughout the United States. These sites contain modules from several manufacturers and serve as test beds for photovoltaic system components. The activities of the Materials, Processes and Testing Laboratory of the Solar Photovoltaic Field Tests and Application Project during the period of July through October 1980, are summarized.

13627 (DOE/NASA/0049—80/2) Market definition study of photovoltaic power for remote villages in developing countries. Ragsdale, C.; Quashie, P. (Motorola, Inc., Phoenix, AZ (USA)). Oct 1980. Contract AI01-76ET20485. 210p. (NASA-CR—159880). NTIS, PC A10/MF A01.

The objective of this market definition study is to assess the market potential for the use of photovoltaic power systems for remote villages in developing countries. The approach used was to conduct an in-depth literature search followed by in-country surveys of selected developing countries in Africa, the Middle East, Southeast Asia, and Latin America. The purpose of these surveys was to determine the current energy situation in these countries, the level of rural electrification activity, their knowledge and interest in solar and specifically photovoltaics, their financial resource capability, and the probability of development of a market for photovoltaics based on these and other factors. Findings are presented. The conclusion reached by the survey is that there is a significant market potential for photovoltaics in village power applications in developing countries. Extrapolation of the number of unelectrified villages results in an estimated potential of as much as 20,000 MWp, a potential similar in magnitude to previous UN and World Bank estimates. Recommendations for market stimulation are presented. (WHK)

13628 (SAND—80-7083) Economic assessment photovoltaic/battery systems. Final report. Day, J.T.; Hayes, T.P.; Hobbs, W.J. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Systems Technology Div.). Feb 1981. Contract AC04-76DP00789. 132p. NTIS, PC A07/MF A01.

This final report presents results of all technical work performed during the Economic Assessment of Residential Photovoltaic/Battery Systems Study. The economics of residential PV/battery systems are determined from the utility perspective using detailed computer simulation to determine marginal costs. Brief consideration is also given to the economics of customer ownership, utility distribution system impact, and the implications of PURPA.

13629 Planning for electric utility solar applications: the effects on reliability and production cost estimates of the variability in demand. Fegan, G.R.; Percival, C.D. (Sol Energy Res Inst, Golden, Colo). *American Society of Mechanical Engineers, [Paper]*; No. 80-C2/Sol-25, 1-11(1980).

Previous studies have shown the necessity of the consideration of hourly variability in the output from the intermittent generation source. However, the studies did not take into account the variability in the demand. Major questions concerning the variabilities of demand and intermittent source output are listed. Before answers to these questions are attempted, the term variability in demand is clarified by distinguishing between variability due to randomness and variability due to forecasting uncertainty. A result is presented which shows that under general conditions the variability due to randomness can be ignored except in the neighborhood of the peak and minimum demands. The questions are then addressed in terms of the two types of variability in demand. 6 refs.

1407 Solar Thermal Power Systems

13630 (BMFT-FB-T—80-162) Qualification of the MAN-solarfarm-module of the type 3/32 as part of a demonstration program. Final report. Wildenrotter, K. (Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A.G., Muenchen (Germany, F.R.)). Dec 1980. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01.

Based on the first prototype the module was further developed and two new prototypes produced. Optimization of the structure, the collectors, and piping systems is described. Development of tracking electronics, testing and qualification of components, testing of the component assembly concept, and mechanical and thermal testing of the complete module are described. Actions to achieve higher efficiency and to reduce production costs, and application of alternative mirror elements are discussed.

13631 (DOE/SF/10505—3) Solar/hydro integration. (Water and Power Resources Service, Denver, CO (USA)). Jul 1980. Contract AI03-79SF10505. 68p. NTIS, PC A04/MF A01.

The primary objectives of the study were to: 1) determine the technical and economic viability of integrating solar central receiver with the Federal hydroelectric system in the Lower Colorado Region of the Service, and 2) recommend a prime site and an implementation plan for a feasibility study. The central receiver design has been determined by DOE to be the most economically feasible design for use in large power systems (i.e. 100 MWe or larger). Based on DOE's recommendations, two candidate solar receiver systems are being considered for this application. Both are of the Advanced Central Receiver design, each utilizing a central power tower surrounded by a field of two-axis tracking mirrors (heliostats). The principal difference between the two systems is that one uses a molten salt as its heat transfer fluid whereas the other system uses liquid sodium. A description of the Federal hydroelectric power system is given, and a projection of the energy needs for the Lower Colorado service area is presented. Details of the site selection, solar plant evaluation, solar/weather data analysis, energy analysis, integration analysis, economic analysis, environmental analysis, and implementation plan are reported. (WHK)

13632 (SAND—79-8194(Vol.1)) Second generation heliostat development detailed design report. Volume I. Technical discussion. Period covered: July 16, 1979-April 30, 1980. (Northrup, Inc., Hutchins, TX (USA); Bechtel National, Inc., San Francisco, CA (USA); Booz, Allen and Hamilton, Inc., Cleveland, OH (USA)). 1980. Contract AC04-76DP00789. 265p. NTIS, PC A12/MF A01.

Presented are the design of the second generation heliostat, the development of the manufacturing plan, the method of transporting the heliostats from the factory to the installation site, heliostat installation procedures, and the maintenance routines. These plans are then cost estimated to provide inputs required to develop the installed cost of the heliostat and further, the cost of owning, operating and maintaining a collector field. It is a dual axis tracking heliostat with a central pedestal mount. The normal show position is vertical but under anticipated extreme high wind conditions it is

driven to a horizontal orientation with the reflective surfaces facing up. The gross face area of the heliostat is approximately 25 feet by 25 feet. Due to mirror module spacing and edge treatment the net reflective area is 568 square feet or 52.8 square meters. Each mirror module is nominally 4 feet by 12 feet with a 3 inch depth. Twelve modules comprise the mirror array for each heliostat. The mirror support rack consists of open roof-type trusses which are combined with tubular members which connect to the drive unit. The drive unit is gear-driven with separate motors and gear systems for azimuth and elevation. The foundation for the drive consists of a one-piece cylindrical pipe which is driven into the soil at the site by conventional pile-driving techniques. (WHK)

13633 **Design of a solar receiver for a 25-kWe gas turbine engine.** Greeven, M.; Coombs, M.; Eastwood, J. (AiRes Manuf Co of Calif, Torrance). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-131, 1-5(1980).

This paper describes a solar receiver under development for the Department of Energy under contract to the Jet Propulsion Laboratory. The receiver is designed to be used with a single-point-focus, parabolic concentrator. The receiver accepts the concentrated solar radiation and uses it to heat the working gas of a small, open-cycle gas turbine to about 1500 F (815 C). The receiver employs a high-efficiency, metallic plate-fin heat transfer surface to effect this energy transfer. The paper discusses the thermal and mechanical design features of the receiver.

13634 **Color graphic controls for the solar central receiver test facility.** Darsey, D.M. (Sandia Lab, USA). *ISA (Instrument Society of America) Transactions ;* **19**: No. 2, 65-74(1980).

The world's largest solar thermal facility uses a single operator to control and supervise experiments. The critical man-machine interface with the computerized control and data system is an intelligent, refresh color graphics system with separate consoles for the operator and the experimenter. The graphics hardware, integration software and application programs are discussed as they apply to the real-time control and data presentation of the testing facility. 5 refs.

1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

REFER ALSO TO CITATION(S) 13587

13635 **(DOE/ET/29187—T8) Electric utility system planning studies for OTEC power integration. Final report.** (Florida Power Corp., St. Petersburg (USA)). 30 Nov 1980. Contract AC02-79ET29187. 281p. NTIS, PC A13/MF A01.

Florida Power Corporation (FPC) conducted an evaluation of the possible integration of OTEC into the FPC system. Existing system planning procedures, assumptions, and corporate financial criteria for planning new generating capacity were used without modification. A baseline configuration for an OTEC plant was developed for review with standard planning procedures. The OTEC plant characteristics and costs were incorporated in considerable detail. These basic inputs were examined using the FPC system planning methods. It was found that with the initial set of conditions, OTEC would not be economically viable. Using the same system planning procedures, a number of adjustments were made to the key study assumptions. It was found that two considerations dominate the analysis; the assumed rate of fuel cost escalation, and the projected capital cost of the OTEC plant. The analysis produced a parametric curve: on one hand, if fuel costs were to escalate at a rate greater than assumed (12% vs the assumed 5% for coal), and if no change were made to the OTEC input assumptions, the basic economic competitive criteria would be equivalent to the principal alternative, coal fueled plants. Conversely, if the projected cost of the OTEC plant were to be reduced from the assumed $2256/kW to $1450/kW, the economic competitiveness criterion would be satisfied. After corporate financial analysis, it was found that even if the cost competitive criterion were to be reached, the plan including OTEC could not be financed by Florida Power Corporation. Since, under the existing set of conditions for financing new plant capital requirements, FPC could not construct an OTEC plant, some other means of ownership would be necessary to integrate OTEC into the FPC system. An alternative such as a third party owning the plant and selling power to FPC, might prove attractive. (WHK)

13636 **(LBL—11979) Appropriate zooplankton sampling methodology for OTEC sites.** Commins, M.L.; Horne, A.J. (ed.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1979. Contract W-7405-ENG-48. 9p. (CONF-7907100—(Summ.)). NTIS, PC A02/MF A01.

From Conference on appropriate zooplankton sampling methodology for OTEC sites; Berkeley, CA, USA (9 Jul 1979).

The results of a meeting held July 9-10, 1979 under the auspices of the Marine Sciences Group, Lawrence Berkeley Laboratory, to decide upon a zooplankton sampling program recommended for use in conjunction with environmental monitoring of potential Ocean Thermal Energy Conversion (OTEC) sites are presented. (WHK)

13637 **(ORO—1473-T1(Vol.1)) 100 MWe OTEC alternate power systems. Volume 1. Technical details. Final report.** (Westinghouse Electric Corp., Lester, PA (USA). Power Generation Divs.). 5 Mar 1979. Contract EG-77-C-05-1473. 414p. NTIS, PC A18/MF A01.

The conceptual designs of the OTEC Open Cycle Alternate Power Systems developed by Westinghouse Electric Corporation are described. Component design and cost routines were devised and integrated into a total power system and platform computer optimization code. The highest level of effort was given to the open cycle with surface condenser fresh water production option, followed by the open cycle with direct condenser option and the hybrid cycle power system. An innovative and realistic 100 MWe open cycle net power module and integrated platform emerged as a most cost-effective solution. This 100 MWe power cycle utilizes a flash evaporator, vertical turbine and tubed condenser with dearation designed to take place as part of the condenser venting process, was determined most cost effective. A barometric condenser design was also investigated and has been shown to be worthy of further study. The hybrid cycle using water vapor flashed from a warm seawater flow as a heat source for evaporating anhydrous ammonia in a closed cycle ammonia power loop, was given sufficient attention to determine that it does not appear to be economically attractive. The development of the single large turbine stage, rather than a multiplicity of small turbines, provided significant improvements in reliability and cost. Further, integrating the power system, hull and cold water pipe into a cost optimized platform aided in the solution of the dynamic problem posed by the platform response to sea states, such that the platform motion does not withdraw the warm seawater inlet from the ocean where it would draw air and stall the power system. Design and performance details are presented.

13638 **(PB—80-183981) OTEC cold water pipe: program, problems, and procedures.** McGuinness, T.; Scotti, R.S. (National Oceanic and Atmospheric Administration, Rockville, MD (USA). Office of Ocean Engineering). Mar 1980. 19p. NTIS, PC A02/MF A01.

The purpose of this presentation is to provide a comprehensive overview of the OTEC Cold Water Pipe program. The overview includes a discussion of the technical problems being addressed, the rationale behind the technology development program, and the analytical procedures used to define pipe behavior. Anticipated outputs and application to other marine technologies are also projected. A detailed discussion is presented on the analytical models developed to define the dynamics of the cold water pipe. Analytical results are compared to model test and at-sea test data to indicate the validity of the design tools in predicting pipe motions and stresses.

13639 **(PB—80-199060) Study to determine the commercialization potential of open cycle OTEC water plants. Final report, October 1979-July 1980.** Coffay, B. (Westinghouse Electric Corp., Lester, PA (USA). Steam Turbine-Generator Technical Operations Div.). Jul 1980. Contract MA79-SAC-00063. 419p. NTIS, PC A18/MF A01.

The report surveys the U.S. domestic need for freshwater in regions which are close to an ocean thermal gradient and selects a

single site which appears to have the greatest potential for a commercially viable seawater desalination plant to be located in near shore waters. The selected site is St. Croix, U.S. Virgin Islands. A conceptual design for an open cycle ocean thermal energy conversion plant of 15 million gallons per day (expected plant size for plant to be deployed in year 2005) is described and costed. Possible financing options for the plant are described. Capital and operating costs of a conventional multistage flash evaporator and an open cycle ocean thermal energy conversion plant are examined.

13640 **(PB—80-201825) Recent developments in ocean thermal energy. Technical memo.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Apr 1980. 40p. NTIS, PC A03/MF A01.

This report reviews the status of OTEC technology developments as of April 1980. It discusses major technical accomplishments occurring after publication of the 1978 report and principal technical uncertainties that remain.

13641 **Research on the external fluid mechanics of ocean thermal energy conversion plants.** Adams, E.E.; Fry, D.J.; Coxe, D.H.; Harleman, D.R.F. (MIT, Cambridge, Mass). *MIT (Massachusetts Institute of Technology), Hydrodynamics Laboratory, Technical Report ;* No. 250, 103(Jun 1979).

This report describes the first set of experiments in a physical model study to explore plume transport and recirculation potential for a range of generic Ocean Thermal Energy Conversion plant designs and ambient conditions. Tests were conducted in a thermally-stratified 12 mx18 mx0.6 m basin, at an undistorted length scale ratio of 1:300, which allowed the upper 180 m of the ocean to be studied. Measurements included temperature, dye concentration and visual observations from still photographs. 4 refs.

13642 **(ORO—1473-T1(Vol.2/1)) 100 MWe OTEC alternate power systems. Volume 2. Appendices. Final report.** (Westinghouse Electric Corp., Lester, PA (USA). Power Generation Divs.). 5 Mar 1979. Contract EG-77-C-05-1473. 301p. NTIS, PC A14/MF A01.

The conceptual designs of the OTEC Open Cycle Alternate Power systems developed by Westinghouse Electric Corporation are reported. This volume of the report contains the appendices. Information is presented on the design and dynamic behavior of the platform and cold water pipe, construction and sizing, anchoring, maintenance, and cost. The equations used to calculate nonequilibrium allowance in flash evaporators and the design and performance of the electric generator and exciter for the power system. Brief descriptions of the computer programs used in the design and analyses are included. (WHK)

1409 Solar Thermal Utilization

13643 **(AD-A—087509) A review of the methods for passive solar systems analysis. Master's thesis.** Allan, A.P.; Transmeier, G.D. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Jun 1980. 137p. (AFIT-LSSR—66-80). NTIS, PC A07/MF A01.

Due to recent needs expressed by the Air Force, a review and evaluation of the methods of analysis for passive solar energy systems was conducted. The methods of analysis evaluated were those that could be worked without the use of computers or programmable calculators. A selection model was designed to systematically and objectively evaluate the methods. The selection model was a variation of a scoring model and based on six criteria. The criteria were: Performance, Economics, Flexibility, Implementation, Usability, and Computing Devices. Of the methods evaluated, the Passive Solar Design Handbook was the recommended method of analysis to be used in the Air Force. The method was written by the Los Alamos Scientific Laboratory for the Department of Energy. This method was comprehensive yet simple to use and understand.

13644 **(BMFT-FB-T—80-154) Development of components for the solar heating circuit. Final report.** Moeller, M. (Metallgesellschaft A.G., Frankfurt am Main (Germany, F.R.). Metall-Lab.). Dec 1980. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01.

An aluminium-manganese-zirconium alloy suitable for the Roll-Bond method was developed and a process for the manufacture of solar absorbers on the basis of this material elaborated. Correctly adjusted, inhibited glycol-water mixtures and synthetic heat transfer fluids have proved their value for solar installations with Al-components. Inhibited glycol-water mixtures should be regularly controlled as to their pH-value and the efficiency of the inhibitors. If synthetic heat transfer fluids are used, care should be taken that these and the installation are free from water to avoid corrosion damages. According to the present level of technology, water to which inhibitors or inhibitor mixtures have been added is not suited for that purpose. Solar installations with stagnation temperatures of up to 130°C should be operated with glycol-water mixtures, whereas installations with higher stagnation temperatures are preferably run with synthetic heat transfer fluids.

13645 **(DOE/R5/10127—2) Solar heating panel: Parks and Recreation Building, Saugatuck Township Park and Recreation Commission. Final report.** (Saugatuck Township Park and Recreation Commission, MI (USA)). 4 Dec 1980. Contract FG02-79R510127. 11p. NTIS, PC A02/MF A01.

This report is an account of the design and installation of a solar heating system on an existing building in Saugatuck, MI, using existing technology. The purpose of this program is to demonstrate the possibilities of alternative energy, educate local craftsmen, and make the building more useful to the community. The structure of the building is described. The process of insulating the structure is described. The design of the solar panel, headers, and strong box full of rocks for heat storage is given complete with blueprints. The installation of the system is also described, including photographs of the solar panel being installed. Included is a performance report on this system by Purbolt's Inc., which describes measurements taken on the system and outlines the system's design and operation. Included also are 12 slides of the structure and the solar heating system. (LEW)

13646 **(DOE/TIC—11420) Making of a solar village.** Becker, W.S. (Wisconsin Energy Extension Service, Madison (USA)). 1980. Contract W-31-109-ENG-38. 52p. NTIS, PC A04/MF A01.

The development of a solar-heated central business district in Soldiers Grove, Wisconsin, is described. The following topics are covered: planning, citizen involvement, making a master plan, choosing building designs, legal tools, problems, and other communities trying similar techniques. (MHR)

13647 **(EPRI-EM—1697) Performance monitoring of ground-coupled solar-assisted heat pump systems.** Parker, J.D.; Frierson, B. (Oklahoma State Univ., Stillwater (USA). School of Mechanical and Aerospace Engineering). Feb 1981. 37p. NTIS, PC A03/MF A01.

Three Okalhoma Gas and Electric Company demonstration houses in Perkins, Oklahoma, and the HVAC and data acquisition systems are described. The project involves comparison of the performance of a ground-coupled, solar-assisted heat pump system with that of a ground coupled heat pump system without solar assist, and with a conventional air source heat pump system. Details of the data acquisition and processing system are given. Problems encountered and anticipated are discussed.

13648 **(LA—8450-PR) Solar energy research at LASL. Progress report, October 1, 1979-March 31, 1980.** Reisfeld, S.K.; Neeper, D.A. (comps.). (Los Alamos Scientific Lab., NM (USA)). Nov 1980. Contract W-7405-ENG-36. 56p. NTIS, PC A04/MF A01.

The work of Q-11, the Solar Energy Group of the Los Alamos Scientific Laboratory, is documented for October 1979 through March 1980. Q-11 conducted passive solar heating research and collector testing. In addition, the group provided technical support to the Department of Energy, Office of Solar Applications for Buildings, for both solar collector and passive system development.

13649 (LA-UR—80-3040) Solar load ratio method applied to commercial building active solar system sizing. Schnurr, N.M.; Hunn, B.D.; Williamson, K.D. III. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 31p. (CONF-810405—1). NTIS, PC A03/MF A01.

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The hourly simulation procedure is the DOE-2 building energy analysis computer program. It is capable of calculating the loads and of simulating various control strategies in detail for both residential and commercial buildings and yet is computationally efficient enough to be used for extensive parametric studies. In addition, to a Building Service Hot Water (BSHW) System and a combined space heating and hot water system using liquid collectors for a commercial building analyzed previously, a space heating system using an air collector is analyzed. A series of runs is made for systems using evacuated tube collectors for comparison to flat-plate collectors, and the effects of additional system design parameters are investigated. Also, the generic collector types are characterized by standard efficiency curves, rather than by detailed collector specifications. (MHR)

13650 (LBL—11789) Regional comparisons of on-site solar potential in the residential and industrial sectors. Gatzke, A.E.; Skewes-Cox, A.O. (California Univ., Berkeley (USA)). Oct 1980. Contract W-7405-ENG-48. 155p. NTIS, PC A08/MF A01.

Regional and sub-regional differences in the potential development of decentralized solar technologies are studied. Two sectors of the economy were selected for intensive analysis: the residential and industrial sectors. In both investigations, the sequence of analysis follows the same general steps: (1) selection of appropriate prototypes within each land-use sector disaggregated by census region; (2) characterization of the end-use energy demand of each prototype in order to match an appropriate decentralized solar technology to the energy demand; (3) assessment of the energy conservation potential within each prototype limited by land use patterns, technology efficiency, and variation in solar insolation; and (4) evaluation of the regional and sub-regional differences in the land use implications of decentralized energy supply technologies that result from the combination of energy demand, energy supply potential, and the subsequent addition of increasingly more restrictive policies to increase the percent contribution of on-site solar energy. Results are presented and discussed. It is concluded that determining regional variations in solar energy contribution for both the residential and industrial sectors appears to be more dependent upon a characterization of existing demand and conservation potential than regional variations in solar insolation. Local governmental decisions influencing developing land use patterns can significantly promote solar energy use and reduce reliance on non-renewable energy sources. These decisions include such measures as solar access protection through controls on vegetation and on building height and density in the residential sector, and district heating systems and industrial co-location in the manufacturing sector. (WHK)

13651 (PB—80-115249) Solar thermal components: a bibliography with abstracts. Quarterly update January-March 1979. Bozman, W.R. (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jun 1979. 86p. NTIS PC E12/MF E12.

This bibliographic series cites and abstracts literature and technical papers on components applied to solar thermal energy utilization. The quarterly volumes are divided into ten categories: Material Properties, Flat Plat Collectors, Concentrating Collectors, Thermal Storage, Heat Pumps, Coolers and Heat Exchangers, Solar Ponds and Distillation, Greenhouses, Process Heat, and Irrigation Pumps. Each quarterly volume is compiled from a wide variety of data bases, report literature, technical briefs, journal articles and other traditional and non-traditional sources. The Technology Application Center maintains a library containing many of the articles and publications referenced in the series.

13652 (PB—80-174006) Solar thermal components: a bibliography with abstracts. Quarterly update Aprii-June 1979. Bozman, W.R. (New Mexico Univ., Albuquerque (USA). Technology Application Center). Aug 1979. 121p. NTIS PC E12/MF E12.

This bibliographic series cites and abstracts literature and technical papers on components applied to solar thermal energy utilization. The quarterly volumes are divided into ten categories: Material properties, Flat Plate Collectors, Concentrating Collectors, Thermal Storage, Heat Pumps, Coolers and Heat Exchangers, Solar Ponds and Distillation, Greenhouses, Process Heat, and Irrigation Pumps. Each quarterly volume is compiled from a wide variety of data bases, report literature, technical briefs, journal articles and other traditional and non-traditional sources. The Technology Application Center maintains a library containing many of the articles and publications referenced in the series.

13653 (PB—80-175375) Reporting format for thermal performance of solar heating and cooling systems in buildings. Isakson, P.; Kennish, W.; Ofverholm, E. (Swedish Council for Building Research, Stockholm). Feb 1980. 61p. NTIS, PC A04/MF A01.

In order to effectively assess the performance of solar heating and cooling systems and improve the cost-effectiveness of these systems, common procedures for predicting, measuring, and reporting the thermal performance of systems and methods for designing economical, optimized systems are discussed.

13654 (PB—80-177066) Solar-assisted combination grain drying: an economic evaluation. Agricultural economic report. Heid, W.G. Jr. (Economics, Statistics, and Cooperatives Service, Washington, DC (USA). National Economics Div.). May 1980. 20p. NTIS, PC A02/MF A01.

A solar-assisted combination grain drying system could result in a 53-percent savings in fossil fuel under optimum conditions. It must be integrated into the planned harvest schedule and other farm energy needs for profitable results. Savings under the most favorable conditions studied showed a 6.6-percent return on investment. Solar collectors costing more than $10 per square foot will likely find little acceptance in a combination drying system at current fossil fuel prices.

13655 (PB—80-179245) Simplified energy design economics: principles of economics applied to energy conservation and solar energy investments in buildings. Final report. Marshall, H.E.; Ruegg, R.T.; Wilson, F. (National Engineering Lab. (NBS), Washington, DC (USA)). Jan 1980. 55p. NTIS, PC A04/MF A01.

This handbook introduces the architect and engineer to economic analysis techniques for evaluating alternative energy conservation investments in buildings. Life-cycle cost, benefit-cost, savings-to-investment, payback, and rate-of-return analyses are explained and illustrated. The procedure for discounting is described for a heat pump investment. Formulas, tables of discount factors, and detailed instructions are provided to give the reader all information required to make economic evaluations of energy conserving building designs.

13656 (PB—80-189244) Department of Housing and Urban Development solar hot water initiative: centralized coordination of technical tasks and system evaluation. Final report. Thorsen, R.S.; Hunt, D.F.; Mueller, W.K.; Padhye, A.V.; Priolo, E.P. (Polytechnic Inst. of New York, Brooklyn (USA). Dept. of Mechanical and Aerospace Engineering). Dec 1979. 414p. NTIS, PC A18/MF A01.

This final report describes the installation of 10,867 approved solar hot water heating systems in 10 contiguous Northeastern and Middle Atlantic States and Florida by August 1978. Specific problems, such as availability of standards and test laboratories, installation deficiencies, and warranty requirements, are listed as well as their solutions.

13657 **(PB—80-193576) Solar diffusion in California: a pilot study. Consultant report (final).** Rogers, E.M.; Leonard-Barton, D.; Avi-Itzhak, T.; Rosa, E.; Adhikarya, R. (Stanford Univ., CA (USA). Inst. for Communication Research). Oct 1979. 161p. NTIS, PC A08/MF A01.

The purpose of the study was to determine the level of homeowner awareness about residential solar energy systems, describe characteristics of consumers purchasing solar equipment (e.g. whether they represent identifiable market segments), identify major channels of communication through which solar information is effectively used, determine remaining barriers to solar use, identify needed incentives to accelerate commercialization, and assess public attitudes toward various state and federal government actions to increase the rate of solar energy use statewide.

13658 **(PB—80-195381) How to build a solar still.** Edson, L.; McCracken, H.; Weldy, J. (California Univ., Berkeley (USA). Sea Water Conversion Lab.). 15 Jun 1966. 27p. NTIS, PC A03/MF A01.

Directions for the construction of an inexpensive solar still for utilizing the sun's energy to convert salt water to fresh are presented. Information is given on the materials needed, directions for the use of the still, and expected production rates. This solar still can be built from materials available in most lumber yards, metal-supply houses, and plastic-supply stores. Illustrations are provided for use in the construction of the still.

13659 **(SAN—0307-1(Vol.1)) Solar thermal enhanced oil recovery. Volume I. Executive summary. Final report, October 1, 1979-June 30, 1980.** Elzinga, E.; Arnold, C.; Allen, D.; Garman, R.; Joy, P.; Mitchell, P.; Shaw, H. (Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.; Foster Wheeler Energy Corp., Livingston, NJ (USA); Honeywell, Inc., Minneapolis, MN (USA)). Nov 1980. Contract AC03-79CS30307. 38p. NTIS, PC A03/MF A01.

Thermal enhanced oil recovery is widely used in California to aid in the production of heavy oils. Steam injection either to stimulate individual wells or to drive oil to the producing wells, is by far the major thermal process today and has been in use for over 20 years. Since steam generation at the necessary pressures (generally below 4000 kPa (580 psia)) is within the capabilities of present day solar technology, it is logical to consider the possibilities of solar thermal enhanced oil recovery (STEOR). The present project consisted of an evaluation of STEOR by a team from various Exxon affiliates, Foster Wheeler Development Corp. and Honeywell Inc. The results of the study are presented in three volumes. This volume contains the executive summary. Volume II contains Sections 2 through 8 together with Appendices A through K and in essence is the response to the original contract statement of work. Volume III summarizes the additional work performed to evaluate STEOR as a privately financed commercial venture at Exxon's Edison Field near Bakersfield, California. (WHK)

13660 **(SAN—0307-1(Vol.2)) Solar thermal enhanced oil recovery (STEOR). Sections 2-8. Final report, October 1, 1979-June 30, 1980.** Elzinga, E.; Arnold, C.; Allen, D.; Garman, R.; Joy, P.; Mitchell, P. Shaw, H. (Honeywell, Inc., Minneapolis, MN (USA); Foster Wheeler Development Corp., Livingston, NJ (USA); Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.). Nov 1980. Contract AC03-79CS30307. 357p. NTIS, PC A16/MF A01.

The program objectives were: (1) determine the technical, economic, operational, and environmental feasibility of solar thermal enhanced oil recovery using line focusing distributed collectors at Exxon's Edison Field, and (2) estimate the quantity of solar heat which might be applied to domestic enhanced oil recovery. This volume of the report summarizes all of the work done under the contract Statement of Work. Topics include the selection of the solar system, trade-off studies, preliminary design for steam raising, cost estimate for STEOR at Edison Field, the development plan, and a market and economics analysis. (WHK)

13661 **(SAN—0307-1(Vol.3)) Solar thermal enhanced oil recovery (STEOR). Volume III. Preliminary design for a preheat only solar facility. Final report, October 1, 1979-June 30, 1980.** Elzinga, E.; Arnold, C.; Allen, D.; Garman, R.; Joy, P.; Mitchell, P.; Shaw, H. (Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.; Foster Wheeler Development Corp., Livingston, NJ (USA); Honeywell, Inc., Minneapolis, MN (USA)). Nov 1980. Contract AC03-79CS30307. 101p. NTIS, PC A06/MF A01.

A preliminary design basis for a Solar Thermal Enhanced Oil Recovery Project was developed by the Solar Thermal Systems Division of Exxon Enterprises Inc. (EEI). This design basis consisted of approximatley 100 k square feet of solar collectors for installation at Exxon Company USA's Edison field located seven miles southeast of Bakersfield. The collectors would have been used to preheat water supplied to existing Struthers Wells boilers in order to save fuel. The design was not constructed. The collector field would have been located in the southeast corner of Sector 13. An area of 8.1 acres is required and the collectors would have been enclosed by a fence. The connecting piping distances to existing facilities are 5500 feet for the well water feedline and 5000 feet for the boiler feed hot water lines. Electrical power would have been supplied from a Pacific Gas and Electric substation, 5500 feet to the south-west of the field. A control house with a veiwing gallery for visitors would have been located on the north side of the field. Access to the site would have been from Tower Line Road. The solar collector selected for this field would have been the Acurex model 3001, supplied from Mountainview, California. A total of 144 collectors, 6 feet wide and 120 feet long, are required. This volume of the report presents the design basis, specifications, performance estimates, cost estimates, and schedule.

13662 **(SERI/TP—721-825) Analysis of hybrid solar systems.** Swisher, J. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1980. Contract AC02-77CH00178. 6p. (CONF-801016—19). NTIS, PC A02/MF A01.

From 5. national passive solar conference; Amherst, MA, USA (19 Oct 1980).

This study uses the TRNSYS simulation program to evaluate the performance of active charge/passive discharge solar systems with water as the working fluid. This design was introduced in the Village Homes development in Davis, Calif., and is currently being used by Trident Energy Systems in Davis. TRNSYS simulations are used to evaluate the heating performance and cooling augmentation provided by systems in several climates. The results of the simulations are used to develop a simplified analysis tool similar to the F-chart and Phi-bar procedures used for active systems. This tool, currently in a preliminary stage, should provide the designer with quantitative performance estimates for comparison with other passive, active, and nonsolar heating and cooling designs.

13663 **(SERI/TR—751-747) Active solar heating and cooling information user study.** Belew, W.W.; Wood, B.L.; Marle, T.L.; Reinhardt, C.L. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1981. Contract AC02-77CH00178. 421p. NTIS, PC A18/MF A01.

The results of a series of telephone interviews with groups of users of information on active solar heating and cooling (SHAC). An earlier study identified the information user groups in the solar community and the priority (to accelerate solar energy commercialization) of getting information to each group. In the current study only high-priority groups were examined. Results from 19 SHAC groups respondents are analyzed in this report: DOE-Funded Researchers, Non-DOE-Funded Researchers, Representatives of Manufacturers (4 groups), Distributors, Installers, Architects, Builders, Planners, Engineers (2 groups), Representatives of Utilities, Educators, Cooperative Extension Service County Agents, Building Owners/Managers, and Homeowners (2 groups). The data will be used as input to the determination of information products and services the Solar Energy Research Institute, the Solar Energy Information Data Bank Network, and the entire information outreach community should be preparing and disseminating.

13664 (UCRL—85327) Role of financing in the marketability of capital intensive solar technologies for industry. Dickinson, W.C. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 30 Dec 1980. Contract W-7405-ENG-48. 10p. (CONF-810405—11). NTIS, PC A02/MF A01.

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

Three methods of financing large, capital-intensive, industrial solar systems are examined: conventional end-user financing; conventional lease financing; and the solar management company/limited partnership (SMC). The primary disadvantage of the first method is the large capital investment required of the end-user. The availability of investment capital is limited and other investment priorities usually are dominant. In the latter two methods the end-user is not required to provide any front-end capital. The SMC structure appears particularly attractive in that the end-user pays only for solar energy delivered to the process and is not required to operate and maintain the system. However, certain types of initial government assistance will be needed to make this financing technique feasible.

13665 Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979). 772p. (CONF-791022—).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This conference contains 201 papers, of which 13 are presented in abstract form only. One hundred and eighteen are abstracted separately. The subject matter is primarily concerned with those solar systems in buildings in which thermal energy flow involving conduction, convection, radiation and evaporation is a contributing factor to energy conservation.

13666 (SAN—0307-1(Vol.2)(App.)) Solar thermal enhanced oil recovery (STEOR). Final report, October 1, 1979-June 30, 1980. Elzinga, E.; Arnold, C.; Allen, D.; Garman, R.; Joy, P.; Mitchell, P.; Shaw, H. (Honeywell, Inc., Minneapolis, MN (USA); Foster Wheeler Development Corp., Livingston, NJ (USA); Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.). Nov 1980. Contract AC03-79CS30307. 333p. NTIS, PC A15/MF A01.

The program objectives were to determine the technical, economic, operational, and environmental feasibility of solar thermal enhanced oil recovery using line focusing distributed collectors at Exxon's Edison Field and to estimate the quantity of solar heat which might be applied to domestic enhanced oil recovery. This volume of the report contains the following appendices: (A) detailed site description, (B) additional details of conceptual designs, (C) foundation design for solar collectors, (D) fatigue testing of flexible hoses, (E) design basis, (F) preliminary design: solar control, (G) failure modes and effects analysis of solar thermal systems, (H) basis for preliminary cost estimate, (I) backup for section 8 of final report, (J) environmental impact analysis, and (K) air quality analysis. Engineering drawings and specifications are included. (WHK)

13667 User evaluation study of passive solar residences. Towie, S. (Sol Energy Res Inst, Golden, Colo). pp 4-8 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Speculation exists regarding the readiness of various passive techniques for commercialization and the market potential for residential applications. This paper discusses the preliminary findings of a market assessment study designed to document user experiences with passive solar energy.

13668 Barriers to implementing energy conscious design in housing. O'Riordan, J.P.; Migani, J.C. (TEAMWORKS, Cambridge, Mass). pp 10-14 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper analyzes the preconditions necessary for the diffusion of passive heating and cooling into the homebuilding industry in the northeastern United States. The analysis focuses on passive heating and cooling as an innovation and argues that preconditions are necessary for its diffusion into the homebuilding industry. 6 refs.

13669 Designers are the first market for passive solar innovation. Hart, G.K.; Kurtz, J.M. (Booz, Allen and Hamilton, Bethesda, Md). pp 15-18 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The diffusion of passive design innovation will proceed slowly unless steps are taken to overcome inherent barriers to its early acceptance. This paper suggests that designers are essential in the acceptance of passive design innovation. 9 refs.

13670 Venturing in the passive solar marketplace--a progress report. Schnebly, J.T. (Thermotech Corp, Burlington, Vt). pp 19-22 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The pace of development of active solar systems utilizing off-the-shelf hardware allowed many large companies to dominate the public perception of what solar energy utilization entailed. This paper describes the problems faced by the developer of solar products. 1 ref.

13671 Human behavioral considerations in the planning and design of passive solar systems for commercial facilities: an exploratory study of the effects of sun and shade. Stahl, F.I.; Conway, D.; Goglia, M.R. (NBS, Washington, DC). pp 26-29 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

An exploratory study was conducted to determine whether alterations in sun and shade patterns (which may result from certain passive solar retrofit designs) influence window-shopping and other behavior on retail streets. 6 refs.

13672 Multi level coordination of low cost community produced passive solar systems in Crystal City, Texas. Fisk, P. III. (Cent for Maximum Potential Build Syst, Austin, Tex). pp 30-33 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Small high poverty rural towns in South Texas are experiencing increasing difficulty in supplying energy sources at a price obtainable by their citizenry. This paper attempts to outline how passive solar technologies are an integral part of this redevelopment process and how innovative cross hybridization of appropriate technologies can make many of these attempts affordable.

13673 Project SUEDE: site elevation for solar suitability. Harrigan, M.; Jaehne, D.; Klapper, S.; Ledgerwood, B. (Univ of Mass, Amherst). pp 42-46 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Project SUEDE (Solar Utilization, Economic Development and Employment) is a federally funded, national demonstration solar skills training program. It has trained 13 people to design, understand, site-build and install low-cost passive solar retrofits of three types: solar greenhouse/sunspace collectors, thermo-siphoning air panels, and additional South glazing with storage and night shutters.

13674 **Builders' path to the sun.** Brown, S.M. (Northeast Sol Energy Cent, Cambridge, Mass). pp 50-53 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A simple, inexpensive and effective method to educate the many thousands of home-builders in the Northeast on the fundamentals of passive solar energy has been developed by the technical outreach group of the Northeast Solar Energy Center. This paper reports on how NESEC implements these programs, the objectives of each workshop and the tools employed.

13675 **Passive solar greenhouse program in Wyoming.** Nations, C.H. pp 65-68 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper explores whether a passive solar greenhouse can be made to work in the high, dry, cold climate of Wyoming. Each of the greenhouses built in this fashion is in operation and doing well. The team has had more than 200 students who have learned the principles of passive solar heating and in turn have conveyed the information across the state of Wyoming.

13676 **Sunact.** deSerio, F.; Spears, J.W. (US DOE, Washington, DC). pp 77-80 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

SUNACT, Solar Utilization and Energy Conservation in Cities and Towns, is a program conceived by DOE to promote energy conservation and solar technologies in urban settings. The program is organized into three key elements--planning, research and development, and implementation--to facilitate the transformation of energy-wasteful cities into energy-conscious cities.

13677 **Results of the California passive design competition.** Davis, W.B. pp 83-86 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

California recently sponsored its first statewide Passive Solar Design Competition in an effort to encourage the design and marketing of energy conserving passive energy homes. The goal of the competition was to encourage teams of passive architects and designers to blend their skills with those of the building industry to create passive solar homes which could have widespread appeal.

13678 **Using synoptic weather forecasts at the passive-solar/utility interface.** Howell, W.E.; Fraker, H. pp 101-104 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper considers the impact of solar heating on the operation of the public utilities that provide them with back-up energy, and the relative characteristics of passive and active systems. The third aspect is the application of state-of-the-art synoptic weather forecasting to load management strategies. 7 refs.

13679 **Energy conservation from a lender's perspective.** Campbell, H.D. (Home Fed Sav and Loan Assoc of San Diego, Calif). pp 105-108 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper will identify incentives which lenders have provided to induce customer acceptance of solar and other conservation devices; the response to those incentives; and some progressive ideas for market stimulation being considered for future implementation.

13680 **Resistance network design method for passive solar systems.** Monsen, W.A.; Klein, S.A.; Beckman, W.A.; Utzinger, D.M. (Univ of Wis, Madison). pp 119-123 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A general, computationally simple design method has been devloped to compute the monthly average fraction of the space heating load supplied by either a thermal storage wall or a direct gain system. Existing design methods for these systems were developed by curve-fitting the results of computer simulations for a set of specific reference systems. 15 refs.

13681 **Passive solar, auxiliary heat, and building conservation optimization: a graphical analysis.** Moll, S.; Thayer, M. (Los Alamos Sci Lab, NM). pp 128-131 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper addresses the aspect of overall building design optimization concerning what combinations of passive solar heat gain, auxiliary heat, and building conservation level promote the most efficient use of scarce energy resources. 6 refs.

13682 **Passive application of time-lag techniques and design guidelines for solar energy utilization in residential buildings.** Chiang, R.N.S.; Gordon, C.C. (Va Polytech Inst and State Univ, Blacksburg). pp 132-136 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The phenomenon under investigation in this paper is limited to dynamic heat flow through building elements. The basic principle of Time-Lag Applications is to control the building comfort level by storing and delaying the heat and heat transfer until a more desirable time period. 4 refs.

13683 **Passive solar design for a small office/laboratory building.** Andersson, B.; Kammerud, R.; Place, W. (Univ of Calif, Berkeley). pp 144-147 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

In order to assess the compatibility of existing passive solar design tools with the architectural process, a case study design for a small commercial building has been performed. The architectural process employed in the design is presented. The potential advantages of passive solar design for a small commercial building in an adverse climate are demonstrated. 3 refs.

13684 **Statistical analysis of passive solar buildings--parameters from 200 buildings.** Sullivan, P.W.; Temple, P.L.; Eichen, M.C. (Total Environ Action Inc, Harrisville, NH). pp 148-151 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Two hundred passive solar buildings located throughout the United States were studied in order to examine and document regional differences in passive solar design. The effectiveness of a passive solar building is discussed. This paper presents a brief summary of some of the data and conclusions concerning the 172 buildings in the sample which were single family detached (SFD) housing units.

13685 **Parameters influencing the air flow in thermal storage walls.** Varcolik, F.; Versteegen, P.L. (Sci Appl Inc, McLean, Va). pp 158-162 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The flow rate through a vented storage wall can only be determined experimentally. This paper provides an analytical framework for establishing the important parameters influencing the flow rate in the thermal storage wall. It shows that existing relationships tend to overpredict the flow rate. 2 refs.

13686 **Thermocirculation data and instantaneous efficiencies for Trombe walls.** Hocevar, C.J.; Casperson, R.L. (Energy Eng Group Inc, Golden, Colo). pp 163-167 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Thermocirculation performance characteristics and efficiency data are presented for several wall configurations. Experimental data clearly shows that the natural convection processes occurring in a vented Trombe wall are complex. The data indicates that the instantaneous flat plate collector efficiency curve format also appears to be applicable to Trombe wall systems. 8 refs.

13687 **Thermal radiation calculations for a vertical cylindrical water wall.** Burns, P.J.; Nobe, J.; Winn, C.B. (Colo State Univ, Fort Collins). pp 168-172 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Solar radiation absorption and reflection characteristics of fiberglass reinforced polyester water walls are examined analytically. The fractional amounts of energy reflected into the room, transmitted into the room, and absorbed by the water wall are determined as functions of time.

13688 **Effective absorptance of direct gain rooms.** Burkhart, J.F.; Jones, R.E. Jr. (Univ of Colo, Colorado Springs). pp 173-177 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The effective hemispherical absorptance of a window in a room with diffuse walls of a given absorptance is determined by considering the room to be at a uniform temperature and calculating the radiant energy escaping through the window when multiple internal reflections are considered. 8 refs.

13689 **Seasonal performance analysis of passive solar buildings.** Hyman, H. (Coll of the Atl, Bar Harbor, Me). pp 178-181 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Analysis was shown to develop a concept of "usable solar energy", the fraction of the collected energy that can be effectively stored and used when required. To use the analysis as a design tool, a computer program was written which takes data about the building, the collectors and the local weather and gives a performance analysis for month-to-month auxiliary heat demand.

13690 **Applications of DOE-2 to direct-gain passive solar systems: implementation of a weighting-factor calculative technique.** Schnurr, N.M.; Kerrisk, J.F.; Moore, J.E.; Hunn, B.D.; Cumali, Z.O. (Los Alamos Sci Lab, NM). pp 182-186 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A thermal network computer program has been used to generate weighting factors and to determine the sensitivity of weighting factors to wall mass, mass distribution, solar absorptivity of surfaces, and furniture. Results of these studies are presented. 6 refs.

13691 **Addition of passive solar analysis capabilities to the Oak Ridge Residential Energy Use Model.** Nall, D.H. (Berkeley Sol Group, Calif). pp 191-195 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper describes the addition of passive solar analytical capabilities to the Oak Ridge Residential Energy Use Model. Economic analysis utilizes present value methods and a market penetration algorithm calculates a capture fraction based on the economic performance and the familiarity of the technology. 10 refs.

13692 **SEA-PASS passive simulation program.** Clinton, J.R. (Sol Energy Anal Lab, San Diego, Calif). pp 202-206 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper describes the SEA-PASS computer code developed at Solar Energy Analysis Laboratory to investigate the performance of passively solar heated buildings. The programs are written for execution on a small, micro-processor based computer. Thermal network heat flow equations are solved at time steps of 1/3 hour using finite difference techniques. 4 refs.

13693 **Simulation and optimization techniques for determining energy efficient and cost effective passive home design.** Myers, K.; Icerman, L.; Swift, A. (Washington Univ, St. Louis, Mo). pp 207-211 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A method for evaluating the energy efficiency and costs of passive home design alternatives is described to facilitate assessment of energy conservation options. Performance data from the simulation program and cost data are incorporated into a linear programming optimization model to determine least-cost designs and to predict the corresponding heat flow characteristics. 10 refs.

13694 **Coupling of thermal and lighting simulation programs for evaluating the effectiveness of daylighting design.** Bedrick, J.R.; Emery, A.F.; Heerwagen, D.R.; Kippenhan, C.J.; Millet, M.S.; Varey, G.B. (Univ of Wash, Seattle). pp 212-215 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

While the use of natural lighting can reduce overall energy consumption in a building, the optimization of daylighting design from an energy consumption standpoint can be a complex issue. A procedure has been developed by which thermal and illumination simulation programs can be coupled to allow evaluation of integrated window and artificial lighting system design. The procedure is explained using a case study.

13695 **Modelling passive solar buildings with a small computer system.** Kingrey, W.M. (Gerard and Assoc, Spokane, Wash). pp 216-220 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Two computr programs, used to predict the thermal performance of passive solar heating systems, are presented. The programs are interactive, allowing the user to quickly and accurately evaluate alternative designs. Listings of the programs, written in Basic, are provided. Examples of the inputsand outputs are presented and are used to verify the methods used. 3 refs.

13696 **Free convective energy performance of the Trombe wall--laminar and turbulent.** Borgers, T.R.; Akbari, H. (Humboldt State Univ, Arcata, Calif). pp 221-225 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Several correlations had been developed to enable important overall performance characteristics of the vertical air channel to be estimated given the channel width, height, surface and inlet air temperatures. These correlations permit estimates of the convective heat gain, the mean temperature, and the flow rate of the air leaving the vertical channel. 5 refs.

13697 **LASL similarity studies--1. hot zone/cold zone: a quantitative study of natural heat distribution mechanisms in passive solar buildings.** Wray, W.O.; Weber, D.D. (Los Alamos Sci Lab, NM). pp 226-230 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Interzone distribution of solar heat gains by natural convection provides a viable low-cost alternative to forced air systems. A procedure for developing a general empirical law for interzone transport rates based on data from a small laboratory model and the principles of similitude is outlined. 5 refs.

13698 **LASL similarity studies--2. similitude modeling of interzone heat transfer by natural convection.** Weber, D.D.; Wray, W.O.; Kearney, R.J. (Los Alamos Sci Lab, NM). pp 231-234 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A strict similitude study of natural convection heat transfer through an aperture between two rooms in a passively heated (Trombe wall) building is reported. Similitude numbers, experimental apparatus, experimental techniques and preliminary results are presented and discussed.

13699 **On proper control of direct gain passive solar houses.** Sebald, A.V.; Langenbacher, F.; Clinton, J.R. (Univ of Calif, San Diego). pp 235-240 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Direct gain houses in Albuquerque, NM, Santa Maria, Calif, and Madison, Wis, are studied via simulation to determine their performance in both the presence and absence of backup energy. A model of comfort as a function of occupant absorbed solar radiation is presented and used to compute equivalent temperatures in the space as a function of various shading and venting control strategies. 10 refs.

13700 **LASL/UNM solar economic performance code: a basic primer.** Roach, F.; Ben-David, S. (Los Alamos Sci Lab, NM). pp 247-250 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The LASL/UNM solar economic performance code (model) has been developed to assist in the evaluation of market potential for residential passive solar heating systems on a nationwide basis. Components of the model can be divided into three major categories: inputs, methodology, and output. Each of these categories is briefly described in this paper. 8 refs.

13701 **Quantitative evaluation of solar energy resource base.** Herbert, J.H.; Groveman, B. pp 251-254 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Quantitative evaluation of site specific climatological characteristics (the solar resource base) is required for making optimum choices among alternative passive solar systems. Systems should be matched to prevailing climate. The purpose of this paper is to present two procedures useful for revealing in detail the distribution of measurements on insulation and temperature. 6 refs.

13702 **Architectural response to climatic patterns.** Brown, G.Z.; Novitski, B.J. (Univ of Oreg, Eugene). pp 259-262 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper analyzes several climates in terms of some basic recurring weather patterns, and then classifies these patterns in terms of direct architectural response. This analysis allows the designer to organize and prioritize the vast array of architectural responses in a way that is appropriate for a particular climate. 4 refs.

13703 **Passive solar modeling with daily weather data.** Barley, C.D. (Los Alamos Sci Lab, NM). pp 278-281 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

As part of an effort to devlop a new computer code useful as a routine design tool in the public domain, a study was conducted to determine whether long-term performance can be predicted with suitable accuracy using daily weather data. It is concluded that the potential exists for useful long-term performance predictions based on daily data. Work on a computationally efficient algorithm is currently under way at LASL. 5 refs.

13704 **Graphic methods for determining the solar access design envelope for sites with irregular topography.** Dean, E.T. (Univ of Calif, Berkeley). pp 287-291 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A simple graphic method is developed that enables a building designer to determine a solar access design envelope for sites with irregular topography. It is shown that the solar design envelope consists of a layered series of two-dimensional sun/shadow maps that show regions of full solar access at grade and for incremental heights above grade. 1 ref.

13705 **Computer algorithm of Fanger's model of human comfort.** Bahm, R.J.; Kirschner, C. (Bickle/CM Inc, Albuquerque, NM). pp 292-296 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

An empirical model for human comfort was previously developed by P.O. Fanger. This paper describes one attempt to implement a computer program which could be used as an objective function in the modeling and design process for passive climate conditioning of structures. 8 refs.

13706 **Passive solar design for urban commercial environments.** Hastings, S.R. (NBS, Washington, DC). pp 303-306 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

To investigate the passive use of solar energy in urban commercial environments five generic environments and five passive solar configurations have been defined. Common solar energy issues are summarized. Two of the five generic environments are then examined regarding energy use characteristics, passive solar configurations, and constraints. 7 refs.

13707 **Solar city 2025: the impact of passive buildings.** Milne, M.; Lakin, J. (Univ of Calif, Los Angeles). pp 307-311 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

As part of a study to determine the total energy consumption of a hypothetical city of 100,000 in 2025, a set of prototypical urban buildings was designed and the heating loads and cooling loads were calculated. The uninsulated buildings have roughly 19 times greater heating load and twice the cooling load of the passive buildings.

13708 **Affordable solar house.** Leger, E.H.; Dutt, G.S. pp 317-320 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A "direct gain" solar house was designed and built with insulation levels substantially in excess of those currently recommended for new housing. The combined mortgage payments and fuel bills for a house of this type will be substantially below that of a conventional house built to today's standards. 5 refs.

13709 **Architectural implications of roof pond heating and cooling systems.** Aiello, D.P. pp 329-332 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The utilization of roof pond heating and cooling systems, while conceptually simple, has architectural implications which must be considered in any anticipatory design approach of buildings as integrated systems responsive to human and natural conditions. This paper is based upon the author's experience in building designs using roof ponds.

13710 **Solar greenhouses in Arkansas: an aggressive initiative.** Lawson, J.; Skiles, A. (DOE, Little Rock, Ark). pp 346-350 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The units described have been built and monitored by community agencies and individuals in a variety of climates for the purpose of promoting local self-reliance. The objective of the greenhouses is to provide a good producing space which will use solar energy as its only heat source and grow cool-temperature food crops through the winter.

13711 **Passive solar in industrialized housing.** Schneider-Criezis, S. (Atelier Two Archit, Roselle, Ill). pp 350-353 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

In the past, buildings have been designed with little regard for their energy consumption. This study emphasizes two primary areas: (1) the adaptation of passive solar/energy conservation concepts to industrialized building components, and (2) the incorporation of these concepts and methods into an industrialized housing system in precast concrete. 3 refs.

13712 **Optical illusions: the use of water prisms in passive solar design.** Morrow, J. pp 354-357 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Water prisms are described as a simple and cost effective means of maximizing natural daylighting. As a lighting component, water prisms can be integrated with other solar systems for economic/energy savings, while maintaining good illumination levels and lighting quality.

13713 **Passive energy transport device for solar systems.** Soberman, R.K. (Franklin Res Cent, Philadelphia, Pa). pp 369-372 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A device for transporting thermal energy from a solar roof collector to a lower storage or use area is proposed. The device has a negative coefficient of thermal expansion so that it will sink in water or other fluid medium when heated, become buoyant when allowed to cool and will cycle indefinitely in a normal thermal gradient. 1 ref.

13714 **Venice and the sun.** Fanchiotti, A. (Ist Univ di Archit de Venezia, Italy). pp 373-376 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper deals with different techniques that Venetians have developed over the years to control the sun's influence on their living conditions. Of particular interest appears the variety of movable insulation and shading devices, several examples of which are shown and discussed.

13715 **Unitary system for passive solar windows.** Erb, R.A. (Franklin Inst, Philadelphia, Pa). pp 378-382 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A unitary passive solar window is proposed to be coextruded from clear and white-opaque plastic. This structure combines multiple glazing with dead-air spaces and opaque ribs so as to transmit winter-month solar radiation, block summer-month radiation, and insulate against conductive-convective-reradiative heat losses and gains throughout the year.

13716 **Average transmittance factors for multiple glazed window systems.** Selkowitz, S.; Rubin, M.; Creswick, R. (Univ of Calif, Berkeley). pp 383-386 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Multiple glazing is the most common "static" method of improving the insulating properties of windows. This paper describes simplified calculations of solar heat gain in which a single value for transmittance is chosen, usually the normal transmittance. Whenever such a method is applied, the normal transmittance should be replaced by an averaged value which takes into account the daily and seasonal variations of weather and the angle of incidence. 4 refs.

13717 **Combined convective heat gain and glazing insulation unit.** Abrams, D.W. (South Sol Energy Cent, Atlanta, Ga). pp 389-392 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The use of large glazed areas for passive solar gains may create two problems: reduced visual privacy and increased thermal transmission. A concept is described which integrates a simple thermosiphon air collector and an insulation unit. A removable device provides effective insulation during the night and allows solar gains during the day. 1 ref.

13718 **Effectivness of conventional, modified, and new interior window treatments in reducing heat transfer losses.** Cukierski, G.; Buchanan, D.R. (Cornell Univ, Ithaca, NY). pp 402-406 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This project reports effectiveness in reducing heat transfer losses through single glazed windows of interior window treatments. Testing is conducted on a guarded hot plate. The purpose of this project was to develop new energy efficient window treatments. A review of literature and an analysis of existing conventional treatments provided the basis for formulation of thermal performance criteria. 4 refs.

13719 **Daylight design options--cost benefit analysis.** Pike, T.; Golubov, M. (Ehrenkrantz Group, New York, NY). pp 407-410 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The proper use of perimeter daylighting is shown to conserve energy, limit peak electrical demand and to have significant life cycle cost/benefit impact on a typical, new construction office building in the climate of the New York City region. 2 refs.

13720 **Daylighting design for a new state office building in San Jose, California.** Baker, D. (SOL-ARC, Berkeley, Calif). pp 411-415 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Artificial lighting in large office structures is a significant, and frequently the major energy consuming load. This is especially true when energy conserving/passive design has reduced heating and cooling loads to a minimum. For this reason designs are described which emphasize that daylighting can significantly lower energy use.

13721 **Don't let the trees make a monkey of you.** Holzberlein, T.M. (Principia Coll, Elsah, Ill). pp 416-419 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper treats three topics related to deciduous shuttering for seasonal light control. (1) it discusses the reasons for visual deception in estimating solar flux through barren trees; (2) it discusses the wide disparity among native trees in serving as effective shutters; and (3) it proides a series of recommendations for landscape planning appropriate to the philosophy of passive design.

13722 **Cost effective solar heated earth structures and earth/air tunnels.** Strayer, R.D. (R.D. Strayer Inc, Dublin, Ohio). pp 420-424 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper discusses methods to attain cost effective solar heated earth structures which exceed 95 percent energy saving for heating and cooling. The myriad advantages of earth protection are also listed indicating the proper method of construction.

13723 **Acoustical implications of passive solar building designs.** Paoletti, D.A. (Paoletti/Lewitz/Assoc Inc, San Francisco, Calif). pp 438-442 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The emphasis on energy conservation in the building industry has led to some interesting acoustical implications. This paper will review and discuss some of these implications as they relate to energy-conservation systems and some of the design techniques currently being utilized by architects and engineers in the design of buildings.

13724 **Air management in energy conserving passive solar houses.** Besant, R.W.; Dumont, R.S.; Schoenau, G.J. (Univ of Sask, Saskatoon). pp 443-447 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

In this paper the problem of air management in energy conserving passive solar houses is analyzed and discussed in terms of the cost effectiveness of various alternative schemes. It is concluded that low energy passive solar houses differ appreciably from standard housing in air management. 10 refs.

13725 **Comfort cooling with passive heating solar components.** Blue, H.N. (Sol Gardens, Carthage, NC). pp 454-457 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Comfort cooling is done by using the components of a passive heating system that was operated for the first time in the winter of 1979-80. The heating system will work more effectively using fans for air movement as it will be only partly a natural flow system.

13726 **National assessment of passive nocturnal cooling from horizontal surfaces.** Loxsom, F.M.; Clark, G.; Allen, C.P. (Trinity Univ, San Antonio, Tex). pp 466-570 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The application of passive cooling processes to the sensible cooling of a "Skytherm" type residence is presented as a contour map of the savings in supplemental air-conditioning energy for such a passive residence compared to an energy conserving but conventional building. 2 refs.

13727 **Energy conservation landscaping as a passive solar system.** Parker, D.S.; Parker, J.H. (Fla Int Univ, Miami). pp 471-474 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Research being conducted suggests that for space cooling of dwellings, "precision landscaping" can compete with other passive solar design approaches resulting in a number of hybrid air conditioned and natural cooling models to maximize the potential savings of such a system. 5 refs.

13728 **Cooling from an evaporating, thermosiphoning roof pond.** Crowther, K. (Living Syst, Winters, Calif). pp 499-503 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A computer program simulates the performance of a passive cooling system consisting of a shaded evaporating roof pond which thermosiphons cool water into columns located within a building. Conventional relations for heat transfer to the water mass are compared to experimental data and modified expressions are incorporated into the computer model. 4 refs.

13729 **Passive cooling design approaches: a review of applicability for hot humid climates.** Meyers, A.C. III; May, G.E. (Navarro Coll, Corsicana, Tex). pp 517-521 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The purpose of this paper is to review the various passive design approaches as a function of comfort variables and evaluate their effectiveness for hot, humid climates based on the results of the studies done and the structures designed, built, and tested to date. 1 ref.

13730 **Remarks on the solar contribution of unglazed mass walls.** Rogers, B.T. pp 546-549 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Solar performance of the Ghost Ranch, NM "Sundwelling" adobe housing units (Control, Trombe, Direct Gain, and Greenhouse) based on temperature measurements made in unheated units during February, 1978 is presented. Performance of the Bruce Hunn residence is estimated by use of the Solar Load Ratio (SLR) method. 6 refs.

13731 **Field validity of the overheating intensity curves.** Fuller, W.H. (Total Environ Action Inc, Harrisville, NH). pp 550-554 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Adding direct gain aperture area to a conventional wood frame residential design will, at some point, require the addition of thermal storage to temper potential overheating. Overheating intensity curves to make a reasonable judgment about adding such specially engineered thermal mass are discussed. 3 refs.

13732 **Passive energy conservation and solar renovations used in Asphalt Green project.** Cole, W.J. (NY State Energy Res and Dev Auth, Albany). pp 571-575 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

At the foot of 90th Street on the East River in Manhattan stand two old buildings, uniquely different in scale and character. To provide the conceptual energy framework for the site redevlopment, energy conservation and solar energy schematic design studies were conducted for both buildings. This paper presents the methodology used in identifying, analyzing and selecting the schematic design concepts considered and their integration into overall energy systems for both buildings.

13733 **Design and analysis of passive solar heating solutions for neighborhood commercial strip settings.** Ruberg, K. (NBS, Washington, DC). pp 576-580 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

As part of an NBS study on urban solar applications, passive solar heating methods and preliminary thermal performance data are described for a prototypical neighborhood commercial strip. The energy requirements of this prototypical base case building were calculated with the upper levels vacant. 11 refs.

13734 **Economic evaluation of passive solar designs for urban environments.** Powell, J.W. (NBS, Washington, DC). pp 581-585 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper outlines an economic model for evaluating passive solar designs for commercial buildings and applies the model in several case studies of retrofit systems. Taking into account tax effects and non-thermal as well as thermal benefits of selected passive solar energy systems for space heating, the evaluations show that these systems are cost effective over a wide range of conditions. 2 refs.

13735 **Cost and performance analysis of two retrofit passive solar installations.** Thayer, D.A. (Darryl Thayer and Assoc, St. Paul, Minn). pp 586-589 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The paper describes the cost and performance of passive solar retrofit installations in two Minnesota homes. The first system is a direct gain passive modification to the second story of a two-story residence; it includes an active heat transfer system. There is an analysis of the cost benefit of this system.

13736 **Potential for passive retrofit in Iowa.** Hull, J.R.; Hodges, L.; Block, D.A. (Iowa State Univ, Ames). pp 590-594 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Analysis of data from a survey conducted in several Iowa cities and towns indicate that passive solar retrofit techniques can supply a significant percentage of the residential heating requirements for the state of Iowa. As a conservative estimate, passive retrofit techniques can reduce the auxiliary heating requirements by an average of 20%.

13737 **Mean monthly performance of passive solar water heaters.** Place, W.; Daneshyar, M.; Kammerud, R. (Univ of Calif, Berkeley). pp 605-609 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A simplified analysis was used to compare the average monthly performance of a compact heater and a thermosyphon heater. The comparison, which was made for a range of climates and a variety of load profiles, indicated that the performance of the thermosyphon is substantially superior to that of the compact heater. 2 refs.

13738 **Closed loop air thermosyphon solar water heater--experimental design and performance results.** Muffly, C. (North Ariz Univ, Flagstaff). pp 605-609 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A new panel design and performance results are presented. The panel consists of a closed loop air thermosyphon collector with cooling coils in the top of the panel to remove the heat. A model has been built; instrumenting the model allows for the necessary data to rate the performance of the panel. 4 refs.

13739 **Comparative performance of passive and active solar domestic hot water systems.** Bergquam, J.B.; Young, M.F.; Baughn, J.W. (Calif State Univ, Sacramento). pp 610-614 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Calculations have been made comparing the annual solar contribution of two passive (thermosiphon) and two active (pumped) solar domestic hot water systems for five locations in California. The calculations were performed using the computer program SHOW (Solar Hot Water) which models the storage tank, collectors, auxiliary heaters and load demands. 7 refs.

13740 **Solar-woodstove domestic water heating systems.** Carter, J.; Conrat, R. (Rodale Press, Emmaus, Pa). pp 626-630 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

In summer 1978 the project, "Optimized Solar-Woodstove Domestic Water Heating Systems", received funding through the U.S. Department of Energy's Appropriate Energy Technology Pilot Program. Woodstove water heating was especially attractive in view of the fact that many rural people used or were turning to lower-cost wood energy for their primary space heating fuel.

13741 **Sunburrows, an earth contact/passive solar development.** LaTona, V.C. (Alternative Dwellings, Kansas City, Mo). pp 644-647 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The paper describes how the project became a reality. It discusses site and size considerations, financing for the homes and the development, marketing strategy, maintaining a consistent character and earth contact/passive solar through deed restrictions, and getting builders to construct speculative earth contact.

13742 **Builders' experience with two passive solar houses in Boulder, Colo.** Naumann, R.C. (Robert C. Naumann Constr Consult, Boulder, Colo). pp 654-657 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper illustrates that by using modern construction techniques and cost control, effective solar passive architecture can be implemented by general contractors and speculative home builders at reasonable time and dollar cost. Real cost data and construction procedure are shown so that the information may be used by other solar home builders.

13743 **Deadweight on toothpicks, or putting concrete and brick on wood (and living to tell about it).** Coonley, D.R. (Des-Res-Consult, West Lebanon, NH). pp 666-669 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Two custom designed, passive solar residences utilizing concrete and masonry on wood framing are presented. Their thermal performance during the 1978/79 heating season is analyzed. The cost effectiveness of each design is analyzed and presented for comparison with other systems and design solutions.

13744 **Analysis of the incremental construction costs of passive solar buildings.** Sullivan, P.W.; Katz, M.R. (Total Environ Action Inc, Harrisville, NH). pp 670-673 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper presents an analysis of the incremental construction costs of adding passive solar elements to single-family houses. A series of base case energy efficient buildings was generated from a regional market analysis. Each base case design was then architecturally modified to include one of two generic passive solar options (Direct Gain, Mass Wall). 4 refs.

13745 **Monitoring electric consumption in passive homes--a utility perspective.** Lechner, T.M. (Public Serv Co of NM, Albuquerque). pp 693-696 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper discusses preliminary results from a residential passive solar research project being conducted by the Public Service Company of New Mexico (PNM). The project involves monitoring electrical energy consumption in ten passive solar homes whose backup space and water heating systems use electricity to meet the need when solar cannot.

13746 **Performance simulation of the Tennessee Valley Authority Thomas Village Solar House No. 1 utilizing the MITAS thermal analyzer.** Askew, G.L. (TVA, Knoxville, Tenn). pp 700-703 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The thermal performance of TVA Solar House No. 1 was computer analyzed with the Martin Marietta Thermal Analyzer System (MITAS). Solar House 1 utilizes a double glazed mass wall and some direct gain. The thermal performance was simulated with a model of 24 lumped nodes and 27 conductors which modeled one-dimensional heat transfer. 3 refs.

13747 **Measured thermal performance of a passive solar residence in Bozeman, Montana.** Fowlkes, C.W. (Fowlkes Eng, Bozeman, Mont). pp 704-709 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper summarizes the thermal performance of a passive solar house. Hourly data taken over a three month period during one of the coldest winters on record showed that the solar system was providing 65% of the heating load. 4 refs.

13748 Active and passive solar contribution to the performance of the earth-sheltered Terraset Elementary School. McCulley, J.A.; Michelsen, D.L. (Terraset Found, Reston, Va). pp 710-714 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This school has received considerable attention because of its unique features. This paper provides a general overview of design performance and economics of the school with emphasis on the passive effects of the concrete structure and soil cover.

13749 Thermal performance of an attached solar greenhouse. Stickney, B.L.; Cicero, A. (NM Sol Energy Assoc, Santa Fe). pp 715-718 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Temperature graphs are presented which summarize the annual performance of the greenhouse month by month. It is intended that these results will provide a realistic data base which may be used to facilitate future investigations into the costs and benefits of the attached solar greenhouse. 1 ref.

13750 Performance of a roof-pond solar house. Fate, R.E.; Mancini, T.R. (NM State Univ, Las Cruces). pp 728-732 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

In this paper the first raw data is presented on the performance of a roof-pond solar house located on the campus of New Mexico State University in Las Cruces, New Mexico. The house uses a modification of the SKYTHERM system for environmental control during both the heating and cooling seasons. 10 refs.

13751 Low cost and reliable microprocessor based data acquisition systems applied to the passive solar research experiments at the University of Nebraska. Sash, R.D.; Hollingsworth, E.; Chen, B. (Univ of Nebr, Omaha). pp 749-752 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A series of well instrumented test rooms have been erected on the Omaha campus of the University of Nebraska for the purpose of evaluating the suitability of applying passive solar energy heating and cooling techniques to a Northern climate. Also used was a data acquisition system which centers around an 8080 microprocessor with 8K of RAM, a real time clock and an analog-to-digital converter.

13752 (DOE/CS/30343—1) Passive Solar Commercial Demonstration Program: Phase I. Final report. (North Design, Middleton, WI (USA)). [nd]. Contract FC02-80CS30343. 82p. NTIS, PC A05/MF A01.

Portions of document are illegible.

The passive solar retrofit of a small existing commercial/residential building is described. An add on gallery/sunspace is integrated into the existing structure both in terms of energy and architectural functioning. The sunspace solution maximizes the amount of south facing glass for solar heat gain, while still allowing a deep penetration of daylight into the existing buildings. (MHR)

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 13632, 13644, 13648, 13651, 13652, 13717, 14567

13753 (BMFT-FB-T—80-133) Technological activities for high performance receivers. Final report. Schmidt, G.; Kirner, E.; Zewen, H. (Messerschmitt-Boelkow-Blohm G.m.b.H., Muenchen (Germany, F.R.)). Dec 1980. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01.

For solar thermal power plants the energy transfer efficiency from the incident solar radiation into the heat transfer medium has a direct impact on the overall plant efficiency and influences the size of the cost effective collector field. For this reason technological activities have been accomplished for high performance receivers to be operated in closed Rankine cycles with organic heat transfer media at temperatures between 350°C to 400°C and gas turbine cycles at temperatures between 800°C to 900°C. For receivers cooled by organic media the 20 years experience of the company in the field of rocket propulsion systems could be used to build a test receiver. Under simulated test conditions the thermal and mechanical resistance of the structure and the behavior of different heat transfer media with respect to thermal efficiency and stability have been analyzed.

13754 (PB—80-170244) Updating solar performance criteria and standards. Final report. Holton, J.K. (National Bureau of Standards, Washington, DC (USA)). 1978. 8p. Pub. in Proceedings of Annual Meeting of the American Section of the Int. Solar Energy Soc., Inc. (1978), Denver, CO, August 28-31, 1978, p514-521 1978.

Findings are presented from the residential and commercial demonstration program and from a public commentary process that have led to the updating of numerous sections of the criteria and standards. A comparison is presented of the original criteria, the practical problems and the revised criteria. Topics covered include: system performance covering thermal losses, operating energy, system back-up, thermosyphoning, flow balancing, controls, safety, maintenance and check-out procedures; and component performance covering freeze protection, stratification, stagnation, materials deterioration, and heat transfer fluid quality.

13755 (PB—80-198278) Seasonal performance of a brine pond solar heat collector in New England. von Arx, W.S. (Woods Hole Oceanographic Institution, MA (USA). Dept. of Physical Oceanography). Mar 1980. 34p. NTIS, PC A03/MF A01.

The principles of a modified plot scale Bloch-Tabor brine pond solar heat collector and its operation over the course of a New England winter are described. By stratifying the pond using calcium chloride, a 'cat eye' effect was produced which enabled the pond to act as a whole-sky radiation trap; the freshwater cap served as both an optical and mechanical barrier to heat loss. The pond operated at 24% efficiency in collecting solar radiation. The minimum temperature observed in the brine layer, at a time when the pond was covered by ice, was 24C and the summer maximum was 58C. Modifications to full scale systems, their shortcomings and the environmental constraints associated with this approach are discussed.

13756 (SAND—79-7108) Preliminary optical design of a second-stage concentrator for the CRTF. Final report. Reed, K.A. (Argonne National Lab., IL (USA)). Feb 1981. Contract AC04-76DP00789. 66p. NTIS, PC A04/MF A01.

Sandia Laboratories Albuquerque (SLA) will test an experimental solar receiver designed by McDonnell Douglas/Rocketdyne (MDAC/R) at the Central Receiver Test Facility (CRTF). The 0.89 x 17.1 -m receiver panel is to be tested at power levels of 3 MW/sub th/ and above to provide data for the 24-panel design proposed for the 10-MW/sub e/ Solar-1 plant at Barstow, California. Because of its narrow width, however, the single MDAC/R panel can intercept only about 2.75 MW/sub th/ out of the more than 5 MW/sub th/ directed to a 2.5-m-dia focal zone by the 222 heliostats at the CRTF. Since this focal zone size was fixed in optimizing the facility for full-scale receiver testing, it cannot be reduced practically. It was decided to make the receiver panel appear

wider optically by coupling it to a second-stage, or secondary concentrator. The definition and design of a water-cooled, second-stage compound parabolic concentrator to be employed in the MDAC/R receiver panel testing are described. A Simplified Flux Model (SFM) was developed to permit fast computation of the total power normally incident on an arbitrary planar target aperture from some or all of the heliostats in the field. For each second-stage concentrator configuration studied, the total power normally incident on each entrance aperture was calculated using the SFM, and then the net power delivered to the MDAC/R receiver panel was calculated from the optical transmission of the concentrator. The SFM code is included. (WHK)

13757 **(SAND—80-1964/4) Midtemperature solar systems test facility predictions for thermal performance based on test data: Sun-Heet nontracking solar collector.** Harrison, T.D. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01.

Sandia National Laboratories, Albuquerque (SNLA), is currently conducting a program to predict the performance and measure the characteristics of commercially available solar collectors that have the potential for use in industrial process heat and enhanced oil recovery applications. The thermal performance predictions for the Sun-Heet nontracking, line-focusing parabolic trough collector at five cities in the US are presented. (WHK)

13758 **(SAND—80-1964/5) Midtemperature solar systems test facility predictions for thermal performance based on test data: AAI solar collector with pressure-formed glass reflector surface.** Harrison, T.D. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 22p. NTIS, PC A02/MF A01.

Sandia National Laboratories, Albuquerque (SNLA), is currently conducting a program to predict the performance and measure the characteristics of commercially available solar collectors that have the potential for use in industrial process heat and enhance oil recovery applications. The thermal performance predictions for the AAI solar line-focusing slat-type collector for five cities in the US are presented. (WHK)

13759 **(SAND—80-1964/6) Midtemperature solar systems test facility predictions for thermal performance based on test data: Acurex solar collector with glass reflector surface.** Harrison, T.D. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01.

Sandia National Laboratories, Albuquerque (SNLA), is currently conducting a program to predict the performance and measure the characteristics of commercially available solar collectors that have the potential for use in industrial process heat and enhanced oil recovery applications. The thermal performance predictions for the Acurex solar line-focusing parabolic trough collector for five cities in the US are presented. (WHK)

13760 **(SAND—80-1964/7) Midtemperature solar systems test facility predictions for thermal performance based on test data: Solar Kinetics T-700 solar collector with glass reflector surface.** Harrison, T.D. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01.

Sandia National Laboratories, Albuquerque (SNLA), is currently conducting a program to predict the performance and measure the characteristics of commercially available solar collectors that have the potential for use in industrial process heat and enhanced oil recovery applications. The thermal performance predictions for the Solar Kinetics solar line-focusing parabolic trough collector for five cities in the US are presented. (WHK)

13761 **(SAND—80-1964/8) Midtemperature Solar Systems Test Facility predictions for thermal performance based on test data. Alpha Solarco Model 104 solar collector with 0.125-inch Schott low-iron glass reflector surface.** Harrison, T.D. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1981. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01.

Thermal performance predictions based on test data are presented for the Alpha Solarco Model 104 solar collector, with 0.125-inch Schott low-iron glass reflector surface, for three output temperatures at five cities in the United States.

13762 **(SAND—80-7137) Design and development of a laminated Fresnel lens for point focus pv systems.** Hobbs, R.B. Jr. (General Electric Co., Philadelphia, PA (USA)). Jan 1981. Contract AC04-76DP00789. 69p. NTIS, PC A04/MF A01.

The design and fabrication of a laminated Fresnel lens for point focus photovoltaic concentrators systems is described. The lens consists of a glass superstrate to which a thin 6.7 inch square Fresnel lens is bonded. A key aim of the program was to investigate the technical feasibility of injection molding acceptable quality Fresnel lenses. Significant progress was made in demonstrating this feasibility and is reported.

13763 **(SAND—80-7150) Design and development of a reinforced plastic trough module.** (General Electric Co., Philadelphia, PA (USA). Valley Forge Space Center). Feb 1981. Contract AC04-76DP00789. 103p. NTIS, PC A06/MF A01.

The basic objectives of the program were as follows: (1) survey and screen candidate, large structural part plastic processes; (2) investigate the feasibility of molding accurate trough substrates (not including a reflector) with plastic-process combinations that have the potential to significantly reduce the cost of existing trough concentrator modules; and (3) compile a sufficient materials and process data base so that meaningful conclusions can be formulated as to the cost effectiveness of reinforced plastic trough concentrator modules. A four task program was structured to identify and assess the feasibility of a reinforced plastic trough concentrator module for concentrator solar cells. The first task evaluated candidate materials and processes and compiled material and process data needed for the subsequent trough design effort. The second task built on the compiled material and process data base and formulated a baseline reinforced plastic trough design. During a third task a prototype mold was designed and fabricated which was then used to mold prototype trough segments. A fourth task evaluated the basic structural properties and contour accuracies of the molded trough segments. In addition basic conclusions were formulated as to the technical feasibility and cost effectiveness of large reinforced plastic trough concentrator modules. (LEW)

13764 **Relative merits of black cobalt and black chrome as high temperature selective absorbers.** Smith, G.B.; Ignatiev, A. (Univ. of Houston, TX). *Solar Energy Materials ;* **2**: No. 4, 461-467(Jul 1980).

Solar selectivity, with emphasis on high solar absorptance (α) has been measured in three distinct classes of black cobalt before and after long term exposure to high temperatures (300 to 500°C) in air. Absorption processes in black cobalt and black chrome are quite different, although surface morphology reduces front surface reflections in both systems. However, the thermal stability of the solar absorptance is comparable to black chrome for black cobalt coatings composed of cobalt oxides but not for those composed of cobalt sulphides which are found to be unsuitable at $T > 300°C$ in air. None of the coatings on nickel substrates are suitable for applications at $T > 450°C$ where high absorptance ($\alpha \geq 0.95$) is needed.

13765 **Spiral-passage heat exchanger.** Chubb, T.A. US Patent 4,206,746. 10 Jun 1980. Filed date 10 Mar 1978. 8p.

A spiral passage chemical converter-heat exchanger formed by a cross-sectional rectangular housing containing a pair of rows each containing a plurality of side-by-side passages is described. The rectangular housing is wound into a spiral with the innermost row forming inlet passages and the outermost row forming outlet passages. Thermal contact exists between inflow passages and outflow passages. The outer end of the spiral is connected with an inlet and an outlet. The inlet joins the innermost row of passages and the outlet joins the outermost row of passages. The inner end of the spiral is capped, with a common wall separating the upper and lower passages slotted so that fluid flows from the inlet passages to the outlet passages. As can be seen when the structure is in a spiral, the inlet passages are between the outlet passages with the

outlet passages forming the outer exposed surface of the spiral and the inlet passages forming the surface of the opening through the spiral at the center. A concave sunlight reflector will focus sunlight into the central opening of the spiral thereby heating the fluid in the inlet passages. Since the outlet passages are separated by the inlet passages in the spiral and are in thermal contact therewith, the solar heated outlet fluid will heat the input fluid as it circles the spiral to the outlet passages.

13766 **Thermographic techniques applied to solar collector systems analysis.** Eden, A. (Sol Energy Res Inst, Golden, Colo). *American Society of Mechanical Engineers, [Paper]* ; No. 80-C2/Sol-27, 1-10(1980).

This paper discusses the use of thermography to analyze large solar collector array systems under dynamic operating conditions. The research at the Solar Energy Research Institute in this area has focused on thermographic techniques and equipment to determine temperature distributions, flow patterns, and air blockages in solar collectors. The results of this extensive study, covering many sites and types of collectors, illustrate the capabilities of infrared analysis as a qualitative analysis tool and operation and maintenance procedure when applied to large arrays. Using this analysis, validation studies of large computer codes could examine collector arrays for flow patterns or blockages that could cause disagreement between actual and predicted performance. 8 refs.

13767 **Sundow.** Levine, R.S. (Univ of Ky, Lexington). pp 361-364 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This solar collector is described as one that maximized solar transmission, by using only one sheet of glazing, had the lowest possible operating temperature, i.e. near room temperature, was able to insulate itself when it was not collecting, and was able to do this automatically without complex controls or purchased energy.

1420 Heat Storage

13768 **Study of KCl-CuCl eutectic fused salt as a potential intermediate temperature heat transfer and storage medium.** Etter, D.E.; Wiedenheft, C.J. (Monsanto Research Corp., Miamisburg, OH). Contract AC04-76-DP00053. *Solar Energy Materials* ; 2: No. 4, 423-431(Jul 1980).

A preliminary investigation of the KCl-CuCl eutectic mixture as a potential broad temperature range (150 to > 800°C) heat transfer and storage medium indicated that this eutectic composition may be superior to other high temperature fluids. Density, viscosity, heat capacity, heat of fusion, melting point, compatibility and thermal stability were examined. Based on these preliminary results, it is reasonable to expect operating temperature capabilities from the melting point to in excess of 800°C.

13769 **Thermal storage system for off-peak cooling.** Benton, C.C. (MIT, Cambridge, Mass). pp 493-496 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This system is based on concepts introduced at M.I.T.'s Solar Building 5. The off-peak cooling scheme uses a sodium sulfate based phase change material with a melting point of 66 F. While this storage system has been developed specifically for off-peak cooling, it is also applicable to space heating systems. Solar energy or off-peak electricity can be used as a heat source to cycle a similar PCM mixture with a warmer melting point. 3 refs.

13770 **Design strategies for optimizing the performance of rock storage beds.** Zwart, G. (Shepley Bulfinch Richardson and Abbott, Boston, Mass). pp 537-540 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper describes one rock bed system which is a part of a passive/hybrid solar house in a 6500 degree day climate. The presentation includes information on design, construction, operation and performance for this particular rock storage system with emphasis on lessons learned which might be helpful in the design of similar systems for future applications.

13771 **Salinity gradient solar ponds for passive storage.** Nielsen, C.E. (Ohio State Univ, Columbus). pp 541-545 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Salinity gradient solar ponds are proposed as storage elements within passively heated structures. Calculations indicate that they provide storage adequate for periods of weeks without sun. A numerical example is presented, and practical design considerations are given. Some implications of increased thermal storage capacity are discussed. 1 ref.

15 GEOTHERMAL ENERGY

13772 **(EGG-GTH—5367) Technical assistance and information dissemination efforts at the Idaho National Engineering Laboratory, October 1, 1979-September 30, 1980.** Toth, W.J.; Engen, I.A.; Meltzer, F.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1980. Contract AC07-76ID01570. 29p. NTIS, PC A03/MF A01.

Technical assistance and information dissemination performed by EG and G Idaho's Hydrothermal Commercialization Division (now Geothermal Program Office) at the INEL during FY-80 are described. Requests for technical information increased by one-third over the previous year, and tended to be more specific than previously. Requests for technical assistance generally involved larger projects than previously, and preparation of adequate responses required significantly more time. Information dissemination included 18 exhibits in 10 states plus the District of Columbia, with nearly 400,000 exposures. The work included development and production of major display hardware; preparation and production of a new edition of Rules of Thumb, a much-demanded brochure; and support of State Commercialization Teams by production of customized slide shows for 10 states plus additional support through bulk distribution of brochures and technical documentation on request.

13773 **(LBL—10418) Geothermal resource areas database for monitoring the progress of development in the United States.** Lawrence, J.D.; Lepman, S.R.; Leung, K.; Phillips, S.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1981. Contract W-7405-ENG-48. 73p. NTIS, PC A04/MF A01.

The Geothermal Resource Areas Database (GRAD) and associated data system provide broad coverage of information on the development of geothermal resources in the United States. The system is designed to serve the information requirements of the National Progress Monitoring System. GRAD covers development from the initial exploratory phase through plant construction and operation. Emphasis is on actual facts or events rather than projections and scenarios. The selection and organization of data are based on a model of geothermal development. Subjects in GRAD include: names and addresses, leases, area descriptions, geothermal wells, power plants, direct use facilities, and environmental and regulatory aspects of development. Data collected in the various subject areas are critically evaluated, and then entered into an on-line interactive computer system. The system is publically available for retrieval and use. The background of the project, conceptual development, software development, and data collection are described here. Appendices describe the structure of the database in detail.

1502 Geology And Hydrology Of Geothermal Systems

13774 **(DOE/ET/28365—5) Hydrogeologic and geothermal investigation of Pagosa Springs, Colorado.** Galloway, M.J. (Colorado Geological Survey, Denver (USA)). 1980. Contract AS07-77ET28365. 155p. NTIS, PC A08/MF A01.

The following topics are covered: geology; geophysical surveys; geothermal wells, springs, and heat flow; hydrology; drilling program, well testing, and mineralogical and petrographic studies of samples from geothermal wells. (MHR)

13775 **(LA—8634-MAP) Geologic map of the Sulphur Springs Area, Valles Caldera Geothermal System, New Mexico.** Goff, F.E.; Gardner, J.N. (Los Alamos Scientific Lab., NM (USA)). Dec 1980. Contract W-7405-ENG-36. 36p. NTIS, PC A03/MF A01.

The geologic and tectonic setting and geology of Sulphur Springs Area are described. Geologic faults, sheared or brecciated rock, volcanic vents, geothermal wells, hydrothermal alteration, springs, thermal springs, fumaroles, and geologic deposits are indicated on the map. (MHR)

13776 **(LA—8723-HDR) Geologic framework and hot dry rock geothermal potential of the Castle Dome area, Yuma County, Arizona.** Gutmann, J.T. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01.

The Castle Dome Mountains and surrounding ranges constitute a voluminous pile of silicic volcanic rocks within the Basin and Range province of southwestern Arizona. Previously reported as Cretaceous and Quaternary in age, these volcanics all are of late Oligocene to early Miocene age as indicated by five new K-Ar dates. Reconnaissance field studies indicate that the volcanic section locally has undergone large rotations that contrast with the usual structural style of the Basin and Range and resemble the thin-skinned rotational tectonics documented for earlier, mid-Tertiary extensional deformation in ranges to the north and northeast. Significant geothermal potential of the Castle Dome area is suggested by a shallow depth to the Curie isotherm and by the apparent presence of a good electrical conductor at anomalously shallow depth in the crust. Warm wells exist in the area and Shearer (1979) reported a geothermal gradient of about 70°C/km in a dry well near the center of the gravity low. Radiogenic heat production in the silicic batholith inferred above constitutes a reasonable candidate for a shallow regional heat source.

13777 **(LBL—12039) Numerical simulation of the natural evolution of vapor-dominated hydrothermal systems.** Pruess, K.; Truesdell, A.H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Geological Survey, Menlo Park, CA (USA)). Dec 1980. Contract W-7405-ENG-48. 11p. (CONF-801233—7). NTIS, PC A02/MF A01.

From 6. annual workshop on geothermal reservoir engineering; Stanford, CA, USA (16 Dec 1980).

Simulation of the transient evolution of a cold hydrothermal system into a steady-state partially vapor-dominated system is described. Here the effects of salts and gases were neglected and it was assumed that rock properties are time independent and homogeneous within each part of the system. Despite these simplifications it is believed that the model demonstrates the essential features of a natural hydrothermal convection system. (MHR)

13778 **Active and passive seismic studies of geothermal resources in New Mexico and investigations of earthquake hazards to geothermal development.** Morgan, P.; Daggett, P.H. Las Cruces, NM; New Mexico State University (1980). 50p. (NP—25260; EMD—77-2203).

Seismic data were collected in southwestern New Mexico to investigate the sources of the geothermal anomalies and to investigate the potential earthquake hazards of geothermal development. No major crustal structure anomalies have been located related to known geothermal resources, and no areas of continual seismicity have been identified, which is interpreted to indicate a lack of active, or recently active crustal intrusions in southwestern New Mexico. Without a magnetic heat source, the geothermal potential of the known anomalies is probably limited to intermediate and low temperature applications (<180°C). The lack of continual seismicity indicates low seismic hazard in the area directly related to geothermal development, although the historic and geologically recent tectonic activity should be taken into consideration during any development in the area. A model of forced groundwater convection is presented to explain the geothermal anomalies in southwestern New Mexico, which is consistent with all available geological and geophysical data from the area.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 13774, 13778

1504 Legal And Institutional Aspects

REFER ALSO TO CITATION(S) 13783

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 13783, 14684

13779 **(DOE/EA—0134) Geothermal energy geopressure subprogram.** (Department of Energy, Washington, DC (USA). Div. of Geothermal Energy). Feb 1981. 203p. NTIS, PC A10/MF A01.

The proposed action will consist of drilling one geopressured-geothermal resource fluid well for intermittent production testing over the first year of the test. During the next two years, long-term testing of 40,000 BPD will be flowed. A number of scenarios may be implemented, but it is felt that the total fluid production will approximate 50 million barrels. The test well will be drilled with a 22 cm (8.75 in.) borehole to a total depth of approximately 5185 m (17,000 ft). Up to four disposal wells will provide disposal of the fluid from the designated 40,000 BPD test rate. The following are included in this assessment: the existing environment; probable environmental impacts-direct and indirect; probable cumulative and long-term environmental impacts; accidents; coordination with federal, state, regional, and local agencies; and alternative actions. (MHR)

13780 **(LBL—12166) Numerical studies of the energy sweep in five-spot geothermal production/injection systems.** O'Sullivan, M.J.; Pruess, K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Dec 1980. Contract W-7405-ENG-48. 11p. (CONF-801233—5). NTIS, PC A02/MF A01.

From 6. annual workshop on geothermal reservoir engineering; Stanford, CA, USA (16 Dec 1980).

The present work is aimed at helping to improve the qualitative and quantitative understanding of injection into a geothermal reservoir by considering a few idealized problems. First a vapor-dominated, single layer reservoir is considered, next a vapor-dominated, four layer reservoir, and finally a liquid-dominated, single layer reservoir. In each case varying injection rates are considered and in some cases the injection is changed at different times. The SHAFT9 simulator is used to calculate the reservoir behavior in each case. The calculations are made for a five-spot configuration of alternate, off-set rows of producers and injectors. A calculation mesh with 34 nodes is used, which is barely sufficient to give accurate results. In fact, some of the results exhibit small oscillations with time due to this relatively coarse discretization. (MHR)

13781 **(PNL—3527) Exploratory benefit-cost analysis of environmental controls on hydrothermal energy.** Scott, M.J.; Wells, K.D.; Currie, J.W.; King, M.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 113p. NTIS, PC A06/MF A01.

A study of the value of environmental benefits generated by environmental regulation of hydrothermal sites was initiated to compare these benefits with the estimated costs of regulation. Primary objectives were to 1) evaluate the environmental damages caused by unregulated hydrothermal resource development, 2) use existing environmental and economic data to estimate the dollar

value of preventing expected environmental damages at two sites, and 3) compare the benefits and costs of preventing the damages. The sites chosen for analyses were in the Imperial Valley at Heber and Niland, California. Reasons for this choice were 1) there is a high level of commercial interest in developing the Heber known geothermal resource area (KGRA) and the Salton Sea KGRA; 2) the potential for environmental damage is high; 3) existing data bases for these two sites are more comprehensive than at other sites. The primary impacts analyzed were those related to hydrogen sulfide (H_2S) emissions and those related to disposal of spent hydrothermal brine. (MHR)

1508 Geothermal Power Plants

13782 **(EGG—2077) Semiannual progress report for the Idaho Geothermal Program, April 1 to September 30, 1980.** Ihrig, R.R. (ed.). (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1981. Contract AC07-76ID01570. 30p. NTIS, PC A03/MF A01.

The completion of the 5-MW Pilot Power Plant at the Raft River Geothermal Test Site, modification of the similar, binary cycle Prototype Power Plant, and the water treatment program that studies environmentally safe ways to inhibit corrosion and scaling in geothermal power plants and investigates corrosion resistant materials are summarized. Studies of binary geothermal cycles using mixed hydrocarbon working fluids are described as part of the continuing search for ways to produce low-cost electricity from moderate-temperature geothermal fluids. Progress is reported on studies of direct contact heat exchanger concepts, heat rejection systems, and primary heat exchangers with augmentation. As part of the now-ended series of aquaculture experiments, an unsuccessful attempt to incubate common carp embryos in geothermal waters is reported. An experiment in revegetating disturbed land at Raft River is mentioned and progress on DOE's new User Coupled Confirmation Drilling Program is described. An estimate is presented of the amount of hydrothermal energy that could be produced by the year 2000, with and without Federal assistance, for electric generation and direct applications such as industrial process heat. Progress is reported on the Marketing Assistance Program, through which technical information and assistance is provided potential users and developers of geothermal resources. Also reported is progress in DOE's Program Opportunity Notice (PON) Program demonstration projects and Program Research and Development Announcement (PRDA) Program study projects.

13783 **(P—800-79-015) Decision on the Pacific Gas & Electric Company's application for certification for Geysers Unit 17.** (California Energy Commission, Sacramento (USA)). Sep 1979. 119p. California Energy Commission, Sacramento.

The decision in favor of Geysers Unit 17 is presented. Included in the decisions are the findings, conclusions, and conditions on the following: need, socioeconomics, cultural resources, noise, hydrology and water resources, water quality, soils, biological resources, civil engineering, safety, transmission lines, geotechnical considerations, air quality, public health, and structural engineering and reliability. Provisions for monitoring compliance with applicable laws, regulations, and conditions are incorporated. (MHR)

13784 **Economic comparison of geothermal and conventional electrical energy systems.** Horning, R.R.; Thayer, G.R.; Hardie, R.W.; Williamson, K.D. Jr. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 7-9(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13785 **Analysis of binary thermodynamic cycles for a moderately low-temperature geothermal resource.** Demuth, O.J. (EG and G Idaho, Inc., Idaho Falls). *Transactions of the American Nuclear Society ;* **34**: 16-17(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 13780

13786 **(DOE/ET/28443—T1) Geothermal Loop Experimental Facility. Final report.** (San Diego Gas and Electric Co., CA (USA)). Apr 1980. Contract AC03-76ET28443. 715p. NTIS, PC A99/MF A01.

Research at the Geothermal Loop Experimental Facility was successfully concluded in September 1979. In 13,000 hours of operation over a three and one half year period, the nominal 10 megawatt electrical equivalent GLEF provided the opportunity to identify problems in working with highly saline geothermal fluids and to develop solutions that could be applied to a commercial geothermal power plant producing electricity. A seven and one half year period beginning in April 1972, with early well flow testing and ending in September 1979, with the completion of extensive facility and reservoir operations is covered. During this period, the facility was designed, constructed and operated in several configurations. A comprehensive reference document, addressing or referencing documentation of all the key areas investigated is presented.

13787 **(LBL—12033) DOE code comparison study: summary of results for problem 4: expanding two-phase system with drainage.** O'Sullivan, M.J. (Lawrence Berkeley Lab., CA (USA)). Dec 1980. Contract W-7405-ENG-48. 7p. (CONF-801233—6). NTIS, PC A02/MF A01.

From 6. annual workshop on geothermal reservoir engineering; Stanford, CA, USA (16 Dec 1980).

The reservoir in this problem consists of two layers each 1km thick with the upper layer less permeable than the bottom one. The initial temperature in the reservoir drops linearly from 310°C at the bottom of the reservoir to 290°C at the interface between the two layers and then drops more steeply, but still linearly to 10°C at the ground surface. The initial pressure distribution is the hydrostatic profile corresponding to this temperature distribution. The reservoir is produced at the bottom of the system at a rate of 100 $kg/s.km^2$. It is assumed that the system and the production are uniform in the horizontal directions so that flow occurs in the vertical direction only. A calculation grid of 20 equal sized blocks is specified and results are required for a 40 year period. The anticipated behavior of the reservoir is that a boiling zone will develop near the top of the more permeable layer and spread downwards, also spreading a short distance into the upper layer. As the pressure drops in the lower layer, down flow through the top layer and recharge at the ground surface will be induced.

13788 **(SAND—79-7123) Factors affecting seal life in downhole motors.** Dareing, D.W. (Maurer Engineering, Inc., Houston, TX (USA)). Jan 1980. Contract AC04-76DP00789. 48p. NTIS, PC A03/MF A01.

The life expectancy of rotary seals in downhole motors depends on temperature generated by sliding friction as well as ambient temperature. Heat transfer calculations show that sliding friction can produce a significant rise in temperature across seal assemblies, great enough to deteriorate the seal material and cause premature failure. Thermal conductivities of seal materials and thicknesses of shaft, sleeve, and housing are major design factors influencing steady state temperature profiles across seal assemblies. In general, smaller dimensions and higher thermal conductivities allow the friction generated heat to dissipate at a lower temperature. A parameter study led to an improved rotary seal configuration which will significantly lower peak seal temperatures in downhole motors. The design will channel drilling mud near the sliding friction surface for better dissipation of the friction generated heat. Plans are being made to incorporate this improvement into the bearing seal test assembly. It is doubtful that seals made of Buna-N will perform successfully on downhole motors, even when used in the improved design. On the other hand, calculated maximum temperatures are within material limitations of Grafoil.

13789 **Interwell tracer analyses of a hydraulically fractured granitic geothermal reservoir.** Tester, J.W.; Potter, R.M. Dallas, TX; Society of Petroleum Engineers (1979). 12p. (LA-UR—79-2005). American Institute Mining and Metallurgical Engineers, Incorporated, New York, NY.

From 54. annual fall technical conference and exhibition of the Society of Petroleum Engineers of AIME; Las Vegas, NV (USA) (23 Sep 1979).

Field experiments using fluorescent dye and radioactive tracers (^{82}Br and ^{131}I) have been employed to characterize a hot, low-matrix permeability, hydraulically-fractured granitic reservoir at depths of 2440 to 2960 m (8000 to 9700 ft). Tracer profiles and residence time distributions have been used to delineate changes in the fracture system, particularly in diagnosing pathological flow patterns and in identifying new intection and production zones. The effectiveness of one- and two-dimensional theoretical dispersion models utilizing single and multiple porous, fractured zones with velocity and formation dependent effects are discussed with respect to actual field data.

1510 Direct Energy Utilization

13790 **(BNL—28892) Generic model for district heating: a geothermal appliance.** Reisman, A. (Brookhaven National Lab., Upton, NY (USA)). Nov 1980. Contract AC02-76CH00016. 13p. (CONF-801137—3). NTIS, PC A02/MF A01.

From Workshop on energy policy analysis; Urbino, Italy (3 Nov 1980).

Brookhaven National Laboratory (BNL) is developing a model desgined to assess the engineering and economic requirements which must be addressed when the implementation of district heating is seriously considered. A brief overview of the structure of the BNL District Heating Model is presented, including a discussion of the function of each of its major program components. The model is composed of four submodels, each of which serves a distinct function in the analysis of district heating. These are the Heat Demand, Heat Source, District Heating, and Market analysis Submodels. (MHR)

13791 **(DOE/ID/01757—3) Raft River aquaculture project. Final report.** Beleau, M.H.; Woiwode, J.G. (Idaho Univ., Moscow (USA). Coll. of Forestry, Wildlife and Range Sciences). Jul 1980. Contract AS07-78ID01757. 47p. NTIS, PC A03/MF A01.

The commercial potential for geothermal aquaculture was evaluated for 2 years at the Department of Energy's Raft River geothermal site in southcentral Idaho. Common carp '(Cyprinus carpio) and channel catfish (Ictalurus punctatus) were selected as culture species. Objectives of the study included investigation of: (1) growth rates; (2) nutrition trials; (3) histological and physiological parameters; (4) bioaccumulation of heavy metals; and (5) reproductive capacity. The second year project efforts were primarily studying the effects of geothermal water on the reproductive capacity of common carp by: (1) determining the effects of geothermal water on gonadal development of common carp; and (2) determining the effects of geothermal water on common carp embryogenesis.

13792 **(PNL-SA—8503) Economics of geothermal, solar, and conventional space heating.** Fassbender, L.L.; Bloomster, C.H.; Price, B.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 4p. (CONF-800920—29). NTIS, PC A02/MF A01.

From Geothermal Resource Council annual meeting; Salt Lake City, UT, USA (9 Sep 1980).

The competitive outlook for geothermal and solar heating changed dramatically during the past year. With the recent sharp price increases in imported oil and natural gas and the planned decontrol of domestic prices, geothermal and solar energy will become competitive for space heating throughout most of the country. Under these new conditions, geothermal energy could competitively provide about 40% of the national demand for space heat and domestic hot water (about 7 quads based on 1980 demands). Nearly all of the geothermal energy demand would be in high-population-density areas. Solar energy could competitively provide about 50% (about 9 quads) of the annual demand. Most of the solar energy demand would be concentrated in suburban and rural areas. Conventional energy should remain competitive for about 30% (about 5 quads) of the annual demand. Conventional energy demand would be concentrated in the South and as supplemental energy for solar/conventional systems. Geothermal, solar, and conventional energy would be equally competitive for about 20% of the annual demand, which is why the individual market shares add to 120%.

17 WIND ENERGY

13793 **(PB—80-811433) Wind power. 1977-1978 (citations from the NTIS data base). Report for 1977-78.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 263p. NTIS PC N01/MF N01.

The feasibility, use, and engineering aspects of wind power and windmills are discussed in these citations of Federally-funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analyses of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. (This updated bibliography contains 253 abstracts, none of which are new entries to the previous edition.)

13794 **(PB—80-811441) Wind power. 1978-May 1980 (citations from the Engineering Index Data Base). Report for 1978-May 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 305p. NTIS PC N01/MF N01.

Windmill and wind power feasibility, use, and engineering are discussed in these citations of worldwide research. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with the use of wind power in developing countries and comparative analyses of wind power and alternative energy sources are included, as are studies on energy storage systems. (This updated bibliography contains 299 abstracts, 174 of which are new entries to the previous edition.)

13795 **(PB—80-811458) Wind power. 1979-May 1980 (citations from the NTIS data base). Report for 1979-May 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 145p. NTIS PC N01/MF N01.

The feasibility, use, and engineering aspects of wind power and windmills are discussed in these citations of Federally-funded research reports. Abstracts primarily cover the use of wind power for electric power generation and wind turbine design and performance. General studies dealing with comparative analyses of wind power and alternative energy sources are included, as are energy storage devices which can be used in these systems. (This updated bibliography contains 135 abstracts, 112 of which are new entries to the previous edition.)

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 13589, 13807

13796 **(AD-A—087812) AFB, Wa. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a-f. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 20 Jun 1980. 429p. NTIS, MF A01.

This report is a six-part statistical summary of surface weather observations for McChord AFB, WA. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.

13797 **(AD-A—087815) Zweibrucken, AB DL. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a-f. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 19 Jul 1979. 400p. NTIS, MF A01.

This report is a six-part statistical summary of surface weather observations for Zweibrucken AB, DL. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.

13798 **(AD-A—087822) Schwaebisch Hall AAF, DL. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a-f. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 17 Aug 1979. 357p. NTIS, MF A01.

This report is a six-part statistical summary of surface weather observations for Schwaebisch Hall AAF, DL. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.

13799 **(AD-A—087823) Loring AFB, Caribou, Maine. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a-f. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 27 Jun 1980. 475p. NTIS, MF A01.

This report is a six-part statistical summary of surface weather observations for Loring AFB, Caribou, ME. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables. (Author)

13800 **(AD-A—087824) Misawa AB, Japan. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a-e. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 3 Jul 1980. 395p. NTIS, MF A01.

This report is a six-part statistical summary of surface weather observations for Misawa AB, JP. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.

13801 **(AD-A—087825) Kingsley Field, Klamath Falls, Oregon. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a-f. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 16 Jul 1980. 455p. NTIS, MF A01.

This report is a six-part statistical summary of surface weather observations for Kingsley Field, Klamath Falls, OR. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.

13802 **(AD-A—087826) Monterey FAA, Monterey, California. Revised Uniform Summary of Surface Weather Observations (RUSSWO). Parts a, c-f. Final report.** (Air Force Environmental Technical Applications Center, Scott AFB, IL (USA)). 24 Jul 1980. 394p. NTIS, PC A17/MF A01.

This report is a six-part statistical summary of surface weather observations for Monterey FAA, Monterey, CA. It contains the following parts: (a) Weather Conditions; Atmospheric Phenomena; (b) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (c) Surface winds; (d) Ceiling versus Visibility; Sky Cover; (e) Psychrometric Summaries (daily maximum and minimum temperatures, extreme maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry-bulb temperature, means and standard deviations of dry-bulb, wet-bulb and dew point temperatures and relative humidity); and (f) Pressure Summary (means, standard deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form, in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurrence tables.

13803 **(PB—80-195167) Wind resource assessment in California. Contractor report (final).** Berry, E.X. (Atmospheric Research and Technology, Inc., Sacramento, CA (USA)). May 1980. 77p. NTIS, PC A05/MF A01.

The report provides a strategy for wind-energy prospecting, a design for a wind prospecting instrument, and a method of analysis of wind-energy data. The formulation also produces an improved basis for the calculation of wind machine performance using only a few wind parameter measurements.

1704 Economics

13804 **National wind energy construction program: its energy and economic impact.** Curtis, E.H. Washington, DC; Department of the Interior (1980). 25p. (CONF-800264—15). American Public Power Association, Washington, DC.

From 24. American Public Power Association annual engineering and operations workshop; Phoenix, AZ, USA (25 Feb 1980).

Developing the 1.7 quad wind energy portion of the 18.5 quad (20 percent) National Renewable Energy Coal translates into 500,000 million kWh/year of electrical power generation. If, for example, wind dynamos that produced 10 million kWh/year were used, 50,000 large wind machines would be required. A Near-Term Goal of 5000 MW by 1989 is needed to develop the manufacturing industry and is appropriate as a start toward 500,000 kWh/year by

the year 2000. Analyses of wind energy development at this level were found to be feasible. A 20 year construction schedule for 24,000 wind dynamos which would have a 60,000 MW capacity and produce about 200,000 million kWh/year is presented and economic analyses were performed. The analyses showed that development was cost effective and would show a profit, without including the value of displaced energy costs.

13805 **(SERI/TP—732-1064) Value analysis of wind energy systems to electric utilities.** Percival, D.; Harper, J. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1981. Contract AC02-77CH00178. 9p. (CONF-810405—10). NTIS, PC A02/MF A01.

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A method has been developed for determining the value of utility-operated wind energy systems to electric utilities. The analysis is performed by a package of computer models that interface with most conventional utility planning models. Weather data are converted to wind turbine output powers, which are used to modify the utility load representation. Execution of the utility planning models with both the original and modified load representation yields the gross and marginal value ($/rated kW/) of the added wind energy systems. This value is then compared with cost estimates to determine if for economic reasons the wind energy system should be included in future generation plans.

1706 Wind Energy Engineering

13806 **(PB—80-171218) Hybrid energy system: wind and water.** Fordham, J.W.; Peck, M.K.; McMullen, R.; Cunningham, A.B. (Nevada Univ., Reno (USA). Water Resources Center). Feb 1980. 78p. NTIS, PC A05/MF A01.

The potential for using wind together with hydro generation to meet small area energy demands was examined and a prototype wind-hydro system was modeled for a Nevada site to determine optimum component sizes and operation. The wind-hydro system is designed as an alternative to conventional power generation methods especially in remote areas where the construction of transmission lines is not economically practical. The system includes a reservoir to catch as much runoff as possible, a hydroelectric generation plant, a wind turbine, and a generator. To offset the variability of energy supply from the wind, energy conversion systems (WECS) drive recharge pumps to the upstream reservoir where water is stored to be released to drive the hydroelectric generators when needed for a steady energy supply. Costs and benefits are examined in a generalized manner for six preliminary designs then in detail for a wind-hydro system located on Slide Mountain in Nevada.

13807 **(PNL—2522) Meteorological aspects of siting large wind turbines.** Hiester, T.R.; Pennell, W.T. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1981. Contract AC06-76RL01830. 512p. NTIS, PC A22/MF A01.

This report, which focuses on the meteorological aspects of siting large wind turbines (turbines with a rated output exceeding 100 kW), has four main goals. The first is to outline the elements of a siting strategy that will identify the most favorable wind energy sites in a region and that will provide sufficient wind data to make responsible economic evaluations of the site wind resource possible. The second is to critique and summarize siting techniques that were studied in the Department of Energy (DOE) Wind Energy Program. The third goal is to educate utility technical personnel, engineering consultants, and meteorological consultants (who may have not yet undertaken wind energy consulting) on meteorological phenomena relevant to wind turbine siting in order to enhance dialogues between these groups. The fourth goal is to minimize the chances of failure of early siting programs due to insufficient understanding of wind behavior.

13808 **(PNL-SA—9066) Effect of site wind characteristics on energy production.** Pennell, W.T.; Wegley, H.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Dec 1980. Contract AC06-76RL01830. 20p. (CONF-801210—20). NTIS, PC A02/MF A01.

From 3. Miami international conference on alternative energy sources; Miami Beach, FL, USA (15 Dec 1980).

The effect of differences in wind characteristics on estimates of wind turbine performance has been examined. Net energy production over a given period can be estimated if both the performance characteristics of the turbine and the wind speed probability density function (PDF) are known. Simulations covering a range of PDFs and machine performance characteristics showed that reasonable estimates of net energy production can be made using simple, analytical PDFs. The analytical PDFs only require knowledge of the average wind speed at a site. Some wind energy applications require knowledge of how temporal variations in turbine output interact with temporal variations in the load. The effect of variations in the diurnal modulation of wind speed on load matching was examined by simulating the energy transfer between a utility and a residence equipped with a small wind turbine generator. Turbine performance was simulated at six sites having a wide range of diurnal characteristics.

13809 **(SAND—80-2469) Comparison of field and wind tunnel Darrieus wind turbine data.** Sheldahl, R.E. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1981. Contract AC04-76DP00789. 18p. NTIS, PC A02/MF A01.

A 2-m-dia Darrieus Vertical Axis Wind Turbine with NACA-0012 blades was extensively tested in the Vought Corporation Low Speed Wind Tunnel. This same turbine was installed in the field at the Sandia National Laboratories Wind Turbine Test Site and operated to determine if field data corresponded to data obtained in the wind tunnel. It is believed that the accuracy of the wind tunnel test data was verified and thus the credibility of that data base was further established.

13810 **(SAND—80-2646C) Vertical axis wind turbine drive train transient dynamics.** Clauss, D.B.; Carne, T.G. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 17p. (CONF-810226—1). NTIS, PC A02/MF A01.

From 2. DOE/NASA wind turbine dynamics workshop; Cleveland, OH, USA (24 Feb 1981).

Start-up of a vertical axis wind turbine causes transient torque oscillations in the drive train with peak torques which may be over two and one-half times the rated torque of the turbine. These peak torques are of sufficient magnitude to possibly damage the drive train; safe and reliable operation requires that mechanical components be overdesigned to carry the peak torques caused by transient events. A computer code, based on a lumped parameter model of the drive train, has been developed and tested for the Low Cost 17-Meter turbine; the results show excellent agreement with field data. The code has subsequently been used to predict the effect of a slip clutch on transient torque oscillations.

20 ELECTRIC POWER ENGINEERING

REFER ALSO TO CITATION(S) 14163, 14211

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 13769, 14091, 14095, 14126, 14143, 14170, 14212, 14281, 14329, 14329, 14331, 14344, 14344, 14782

13811 **(ANL-CT—80-3(Add.1)) DOE/ANL/HTRI heat exchanger tube vibration data bank.** Halle, H.; Chenoweth, J.M.; Wambsganss, M.W. (Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 75p. NTIS, PC A04/MF A01.

This addendum to the DOE/ANL/HTRI Heat Exchanger Tube Vibration Data Bank includes 16 new case histories of field experiences. The cases include several exchangers that did not experience vibration problems and several for which acoustic vibration was reported.

13812 **(BMFT-FB-T—80-153) Direct condensation by humid air.** Schwab, S.; Schiebelsberger, B. (Bundesministerium fuer Forschung und Technologie, Bonn-Bad Godesberg (Germany, F.R.)). Dec 1980. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01.

The practicability of direct condensation by humid air (DKFL) for waste heat removal from thermal power plants was investigated in regard to technical, economical and environmental aspects. Research activities included: final investigations on adjustment of a uniform water film in a horizontal test tube; erection of a vertical test tube to study the phenomenon of trickling water film; installation of a pilot plant with a vertical tube bundle to evaluate the main process parameters; analysis and summary of the results of measurement and evaluation of the applicability of the new cooling system; and derivation of a theoretical model to design a DKFL-apparatus. The technical realization of DKFL-process was proved. A vertical geometry of the test tube was much more effective than a horizontal one due to the operational and economical aspects.

13813 **(DOE/ET/29243—T1) Research and development of a unified approach to operations scheduling for electric power under uncertainty. Technical progress report, June 1979-June 1980.** Larson, R.E. (Systems Control, Inc., Palo Alto, CA (USA)). Jun 1980. Contract AC01-79ET29243. 255p. NTIS, PC A12/MF A01.

The objective of this study was to develop a unified approach for operations schedulng in electric power systems that explicitly takes into account sources of uncertainty present at all levels in this problem. This objective requires formulating the operations scheduling problem as a single, integrated problem, and developing solution methodologies that start from this integrated formulation and progress to subproblem solution methods that are consistent with it. Progress for the first year of the project is reported. Information is included on: problem definition; time-scale decomposition; stochastic optimization of both parallel and series reservoir systems; stochastic production simulation; maintenance scheduling and nuclear refueling; and short-term resource scheduling. (LCL)

13814 **(DOE/TIC—3360(Suppl.5)) Cooling towers: a bibliography.** Whitson, M.O. (ed.). (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). Feb 1981. 87p. NTIS, PC A05/MF A01.

This bibliography cites 300 selected references containing information on various aspects of large cooling tower technology, including design, construction, operation, performance, economics, and environmental effects. The towers considered include natural-draft and mechanical-draft types employing wet, dry, or combination wet-dry cooling. A few references deal with alternative cooling methods, principally ponds or spray canals. The citations were compiled for the DOE Energy Information Data Base (EDB) covering the period January to December 1980. The references are to reports from the Department of Energy and its contractors, reports from other government or private organizations, and journal articles, books, conference papers, and monographs from US originators.

13815 **(EPRI-CS—1668) Development of an advanced concept of dry/wet cooling of power-generating plants. Interim report.** Johnson, B.M. (ed.). (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1981. Contract AC06-76RL01830. 170p. NTIS, PC A08/MF A01.

A large-scale test of dry/wet cooling using the ammonia phase-charge system, designated the Advanced Concepts Test, is being constructed at Pacific Gas and Electric Company's Kern Station at Bakersfield. The test facility described in this document will be capable of condensing 60,000 lbs/h of steam from a small house turbine and will use only 25% of the water normally required to reject this heat load in evaporative cooling towers. Two different modes of combining dry and evaporative cooling are being tested. One uses deluge cooling in which water is allowed to flow over the heat exchanger on hot days. The other uses a separate evaporative condenser in parallel to the dry heat exchanger. The design of the cooling system and major components is described and the technology developed to support the design is summarized. The facility is scheduled for completion April 1981. An extensive period of operational acceptance tests will follow. Research testing is anticipated to begin about the middle of 1981.

13816 **(EPRI-EL—1424(Vol.1)) Determination of synchronous machine stability study models. Final report.** (Westinghouse Electric Corp., East Pittsburgh, PA (USA)). Feb 1981. 168p. NTIS, PC A08/MF A01.

The purpose of EPRI Research Project (RP) 997-4 was to experimentally determine generator model parameters to improve the accuracy of power system dynamic stability simulations. Westinghouse used the standstill frequency response test method on several large generators to determine the various standard model parameters traditionally used to represent a synchronous machine. Line switching tests were performed on one of the generators. A standard generator model with parameters developed from standstill frequency response tests was utilized in a computer simulation of the line switching test to compare results. The validity check was no more accurate than that obtained when the standard model structure was used with parameters developed from design data. Therefore, Westinghouse cannot conclude that parameters developed from standstill frequency response tests, when utilized in a standard generator model, offered a significant improvement in the mathematical modeling of turbine generators. However, it should be noted that the Ontario Hydro Company conducted similar tests on other generators under EPRI RP997-2 and came to other conclusions. The final report for RP997-2 should be consulted for these conclusions.

13817 **(EPRI-NP—1687(Pt.1)) STRAP: steam turbine rotor analysis program. Part 1. General information manual.** Pennick, H.G. (comp.). (Battelle Columbus Labs., OH (USA); Southwest Research Inst., San Antonio, TX (USA)). Jan 1981. 49p. NTIS, PC A03/MF A01.

The automated Steam Turbine Rotor Analysis Programs (STRAP) have been developed to facilitate the prediction of rotor lifetime given the duty cycle of the turbine and the results of ultrasonic examination from the rotor bore. STRAP consists in part of a preprocessor that generates the boundary conditions and finite element mesh for transient and steady-state temperature and stress analysis. The input thus generated is utilized by ANSYS, a general purpose, finite element structural analysis program. A postprocessor within the STRAP system contains fracture toughness, stress-rupture, yield strength, and fatigue crack growth rate data for air-melted CrMoV forgings, on the basis of which ANSYS-calculated stress and temperature values are screened to determine critical crack size, initial crack size that could grow to critical size within a specified number of hours or cycles, and minimum area fraction of defects which could link to result in a significant crack. A boresonic data reduction program allows rapid scanning of indicated flaw sizes and locations to find the regions of greatest defect density.

13818 **(FE—1806-100) Development of high-temperature turbine subsystem technology to a technology readiness status. Phase II. Quarterly report, October-December 1980.** Horner, M.W. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Jan 1981. Contract AC01-76ET10340. 76p. NTIS, PC A05/MF A01.

A major highlight was the successful testing of two full-scale, water-cooled monolithic, second-stage nozzles in a three-throat cascade. The nozzles were subjected to full machine operating conditions of pressure, temperature, and mass flow for a total of eight hours and 52 simulated startup/shutdown cycles to full operating conditions. The nozzles completed the testing with no indications of distress and performed as expected, which is a significant program achievement. Preparation of two full-scale water-cooled composite first-stage nozzles for testing was also accomplished. The nondestructive evaluation of these nozzles for test readiness revealed that both nozzle segments had indications of small tears in the copper sublayer on the inner endwalls. To avoid delaying the planned testing, a decision was made to test these nozzles in their present condition while the development of these process identified to prevent this copper endwall tear condition continues in parallel and has been demonstrated successfully on two backup nozzle test segments. A modified HIP/heat treatment cycle performed on an available scrap nozzle has indicated successful elimination of the problem. Two complete low-Btu gas staged sectoral combustor assemblies are now available. Preparation for testing one of the combustor assemblies has begun. The instrumentation will be extensive

and is proceeding methodically. The instrumentation of four out of the five sectoral shell/panel sections is currently complete. The test rotor for the water delivery and distribution test was assembled and balanced. The rotor has been installed in the wheelbox test facility and the drive system connected. Rotor balance was again checked and adjusted in the installed configuration. Final preparations for testing are not in progress.

13819 **(PB—80-171291) Near field performance of staged diffusers in shallow water.** Adams, E.E.; Trowbridge, J.H. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Apr 1979. 188p. NTIS, PC A09/MF A01.

The performance of a staged diffuser in shallow water of constant depth has been analyzed previously by treating the diffuser as a continuously distributed line source of momentum (Almquist and Stolzenbach, 1976). This theory has been reviewed and extended to consider the case of a sloping bottom and to compute the external (entrainment) flow field set up by the diffuser. In these analyses the important parameters are the gross diffuser velocity, water depth and diffuser length. Length scales are on the order of one diffuser length, and the characteristics of the individual jets are assumed to be insignificant in describing diffuser performance at this level. A more detailed analysis of staged diffuser performance in the near field is useful if one wishes to describe the temperatures and shear stresses experienced by organisms that are entrained into the diffuser plume.

13820 **(PB—80-175185) Peat as a fuel at the proposed Central Maine Power Company 600 MW plant. Volume I. Final report.** Jones, W.J. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Dec 1979. 187p. NTIS, PC A09/MF A01.

The Central Maine Power Company is planning to construct a 600-megawatt electricity-generating plant at Sears Island, Maine. The plant, as presently conceived, is to employ coal as the input energy fuel form. It has been suggested that peat, which is present in sizeable quantities within the boundaries of the state, be considered instead of coal which has to be imported from other states. This report contains the findings and recommendations resulting from an exploratory assessment of the technical feasibility of using peat instead of coal, and of the economic and institutional issues that may be involved as a result of such a substitution. It is intended for a broad spectrum of readers.

13821 **(PB—80-181696) The powerplant and industrial fuel use act of 1978: its impact on Illinois.** Lytwynyshyn, G.R.; Marder, S.M. (ESCOR, Inc., Evanston, IL (USA)). Aug 1979. 182p. NTIS, PC A09/MF A01.

The purpose of the FUA (Fuel Use Act) is mostly threefold: (1) To reduce the United States dependence on foreign sources of oil, (2) To conserve natural gas and petroleum resources, and (3) To encourage the use of coal and synthetically derived gas from coal or other alternate fuel sources. This study determines the number of installations, both new and existing, in the state of Illinois which will be affected by the FUA and the probable environmental and economic impacts based on actions due to the FUA. All existing and new powerplants and major fuel-burning installations throughout the state were scrutinized. For each type of unit the potential, as well as the probable number of units which fall under the guidelines of the FUA, was determined. The potential number is considered to be the best estimate of all units, both new and existing, which are technically capable of burning coal.

13822 **(PB—80-181902) Assessment of corrosion products from once-through cooling systems with mechanical antifouling devices. Final report, January-April 1979.** Spooner, C.M. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Jan 1980. 50p. NTIS, PC A03/MF A01.

The report gives results of an assessment of corrosion products from steam-electric power plant once-through cooling systems equipped with mechanical antifouling devices. (About 67% of the currently operating plants in the U.S. use once-through cooling systems. Various cleaning mechanisms, used to minimize the reduction of the thermal efficiency of heat exchange in the condenser tubes--caused by corrosion and biofouling--include chemical and off-and on-line mechanical methods.) On-line mechanical cleaning may lead to increased levels of metals in the effluent due to abrasion of the condenser tubes. Since some abraded metals at sufficiently high concentrations harm aquatic organisms and lead to other environmental damage, metal concentrations in cooling water discharges which stem from on-line mechanical condenser tube cleaning systems need to be determined. This report addresses the significance of this effect, based mainly on comments from utilities experienced with the Amertap system and from the manufacturer.

13823 **(PB—80-187750) Economics of disposal of lime/limestone scrubbing wastes: surface mine disposal and Dravo landfill processes. Final report Jun 78-Aug 79.** Veitch, J.D.; Steele, A.E.; Tarkington, T.W. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Div. of Energy Demonstrations and Technology). Feb 1980. 174p. NTIS, PC A08/MF A01.

The report gives results of economic evaluations of flyash and limestone scrubbing waste disposal in a surface mine and in a landfill after treatment with a Dravo Lime Co. chemical additive. For the base case (new 500 MW midwestern plant burning 3.5% S, 16% ash, 10,500 Btu/lb coal), capital investment for the mine disposal process is 16.0 $/kW and annual revenue requirements are 0.98 mill/kWh, compared to 20.0 $/kW and 1.44 mills/kWh for the landfill process, excluding dry flyash collection costs of 19.2 $/kW and 0.56 mill/kWh. A moderate cost reduction is obtained for mine disposal, compared to landfill disposal of the same waste, by eliminating disposal land requirements and reducing earthmoving equipment requirements. Purchasing and handling the chemical additive for the landfill process account for most of the cost differences between the two processes. Power plant size, coal sulfur and ash contents, and distance to the disposal site have major cost effects for both processes. Modular cost breakdowns show purchase and handling of fixatives, thickening, ESP units, and disposal labor to be major cost elements.

13824 **(PB—80-192149) Municipal waste water as a source of cooling water for California electric power plants. Final report.** MacDonald, T. (California Energy Commission, Sacramento (USA)). May 1980. 62p. NTIS, PC A04/MF A01.

This report discusses sources of municipal waste water for potential use as cooling water in California power plants. It notes the major factors which affect this practice. Municipal treatment facilities in California with discharge volumes deemed adequate to supply new power plants are identified. Also included is a summary of the experiences of several utilities in California and other western states with existing or planned applications of municipal waste water in power plant cooling towers.

13825 **(PB—80-192883) Investigation of construction failure of reinforced concrete cooling tower at Willow Island, West Virginia. Final report.** Lew, H.S.; Fattal, S.G.; Shaver, J.R.; Reinhold, T.A.; Hunt, B.J. (National Engineering Lab. (NBS), Washington, DC (USA)). Nov 1979. 195p. NTIS, PC A09/MF A01.

The collapse of the natural-draft hyperbolic concrete cooling tower unit no. 2 at the Pleasants Power Station at Willow Island, West Virginia has been investigated. This investigation included onsite inspections, laboratory tests of construction assembly components and concrete specimens, and analytical studies. Based on the results of these field, laboratory and analytical investigations, it was concluded that the most probable cause of the collapse was due to the imposition of construction loads on the shell before the concrete of lift 28 had gained adequate strength to support these loads. The analysis of the shell indicates that the collapse initiated at the part of the shell in lift 28 where cathead no. 4 was located. It further showed that calculated stress resultants at several points in that part equaled or exceeded the strength of the shell in compression, bending and shear. The failure of these points in that part of the shell would have propagated to cause the collapse of the entire lift 28.

13826 **(PB—80-196652) Coal-fired powerplants' federal permit status report. Third edition.** (Office of Management and Budget, Washington, DC (USA)). May 1980. 125p. NTIS, PC A06/MF A01.

The printout of projected coal-fired powerplants is broken out alphabetically by state, by standard Federal regions, and further subdivided into three distinct categories: Coal-fired powerplants planned and no Federal permitting application received; Coal-fired powerplants with pending Federal permit application; Coal-fired powerplants that have completed the Federal permitting criteria. In the last section of the report labelled Statistics, a summary of the status of permitting actions is shown by standard Federal region, by state within the standard Federal region, and by the total United States.

13827 **(PB—80-197247) Issues related to the reliability of power plants in California. Staff paper (final).** Shurley, L.A. (California Energy Commission, Sacramento (USA)). Dec 1979. 68p. NTIS, PC A04/MF A01.

The paper reflects the concern that without reexamination on the part of the industry of its past policies, traditions and practices, the power plants yet to be licensed in the State of California may not fulfill their full productivity potential. Also, this document seeks a recognition of all parties participating in the regulatory processes, that unless appropriate and deliberate measures are applied, the reliability of the future power generating facilities may be inconsistent with the energy needs, and consequently the reliability deficiency may have to be compensated for by construction of additional generating units that otherwise should not be required. Accordingly, the causes and factors contributing to degradation of power plants reliability are identified, and various means of reduction (or elimination) of such causes, along with related economic aspects are discussed. Basic policies derived from the statutory requirements, the ensuing Commission's role, and the role of the Commission's staff relative to the reliability issues are identified. The contents of this document are applicable to any type of baseload power generating facility. The provided record, pointing to the need for reliability improvement covers the history of nuclear, geothermal, coal, gas, and oil-fired units.

13828 **(PB—80-197767) Preventive maintenance management manual for fossil fuel steam electric generating plants. Final report.** (Kearney (A.T.), Inc., Chicago, IL (USA)). Feb 1980. 210p. NTIS, PC A10/MF A01.

The manual contains all useful elements of a comprehensive preventive maintenance (PM) Program for Fossil Fuel Steam Electric Generating Plants. Instructions are provided to evaluate a specific plant's needs for a formal PM Program, to design a program and install it. A method of evaluating the effect of the PM Program and adjusting it for optimum cost-effectiveness is presented. This manual can be described as a How-To-Do-Yourself Manual in the area of preventive maintenance for Fossil Fuel steam electric generating plants and is unique in concept.

13829 **Diagnostic development for advanced power systems.** Wang, J.C.F.; Flower, W.L.; Hardesty, D.R. (Sandia Lab, Livermore, Calif). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-128, 1-12(1980).

The high temperatures, pressures, and particulate densities present in coal-fired advanced power systems place severe limitations on conventional probe techniques for thermometry, velocimetry, and gas and particulate analysis. This paper describes some of the techniques under development, including a small angle near-forward scattering optical arrangement for particle sizing and a system for making Raman-scattering measurements of gas temperature using a pulsed laser and a gated detection system. The atmospheric combustor exhaust simulator (ACES) facility being constructed as the test bed for the diagnostic techniques is described. 48 refs.

13830 **Diagnostics and instrumentation requirements for advanced power systems.** Hardesty, D.R. (Sandia Lab, Livermore, Calif). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-129, 1-18(1980).

A variety of advanced coal-fired gas turbine systems have been proposed for use in combined cycles for stationary power generation. The commercial acceptability of these power systems will depend upon the efficiency and reliability of the principal individual components. Strict requirements will be placed on the flow characteristics at the turbine inlet. A program is underway of assessment and bench scale development of diagnostic techniques for the measurement of the properties of the high-temperature, multi-phase, turbulent flows which pertain to the working gas stream in such systems. This paper summarizes the preliminary assessment of the diagnostics and instrumentation requirements for these coal-fired gas turbine systems. 71 refs.

13831 **Regeneration of activated bauxite used as a granular sorbent for removing gaseous alkali metal compounds from hot flue gas.** Lee, S.H.D.; Swift, W.M.; Johnson, I. (Argonne Natl Lab, Ill). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-165, 1-9(1980).

Gaseous alkali metal compounds transported form a pressurized fluidized-bed coal combustor (PFBC) to a gas turbine might cause hot corrosion of turbine hardware. Activated bauxite was found to be a very effective granular sorbent for use in granular-bed filters for removing gaseous alkali metal compounds from simulated hot flue gas of PFBC. Observed physical changes and particle attrition of activated bauxite as a result of regeneration are discussed. The sorption mechanisms of the regenerated activated bauxite are related to the chemical compositions of the leachate. 11 refs.

13832 **Development of a coal fired pressurized fluidized bed for combined cycle power generation.** Moskowitz, S.; Weth, G.; Leon, A. (Curtiss-Wright Corp, Wood-Ridge, NJ). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-189, 1-12(1980).

A program to design, construct and operate a pilot electric plant using a pressurized fluidized bed (PFB) combustor burning high sulfur coal to produce electricity at competitive costs and in an environmentally acceptable manner is proceeding under DOE sponsorship. Three components were identified needing experimental test data to validate the selected design configurations or material selections. This paper presents the results of the technology development, and presents the results of the technology development tests. Also, the large scale PFB technology rig design and test program are presented. 2 refs.

13833 **Design and test of a 73-MW water cooled gas turbine.** Caruvana, A.; Rose, R.S.; Alderson, E.D.; Cincotta, G.A. (GE, Schenectady, NY). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-112, 1-20(1980).

This paper presents a preliminary design of a water-cooled gas turbine capable of operating on coal derived fuels and producing 73 MW when burning low Btu coal gas. Particular emphasis is placed on the critical technology issues of combustion and heat transfer at 2600 deg firing temperature. The recent technology developments; i.e., materials developments, composite construction, water cooling, fuels cleanup, etc., which now make this advanced concept possible are discussed. An analytical evaluation is included which demonstrates the advantages of the water-cooled gas turbine in an integrated gasification combined cycle. 13 refs.

13834 **Coal-fired, closed-cycle, gas turbine cogeneration systems.** Campbell, J. Jr.; Lee, J.C.; Wright, D.E. (Rockwell Int, Canoga Park, Calif). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-156, 1-13(1980).

This paper discusses the characteristics and cogeneration potential of the coal-fired, closed-cycle, gas turbine system (in which the working fluid is isolated from the products of coal combustion). Many closed-cycle, gas turbine thermodynamic cycles may be adapted to cogeneration. Parametric performance data are presented. The advantages of closed-cycle, gas turbine system/cogeneration cycles are explored. 3 refs.

13835 **Status of the DOE/NASA critical gas turbine R and T project.** Clark, J.S. (NASA, Lewis Res Cent, Cleveland, Ohio). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-104, 1-10(1980).

The purpose of the DOE/NASA CRT (Critical Research and Technology) Project at the Lewis Research Center is to provide an RandT data base for utility gas turbine systems burning coal-derived fuels. Coal-derived fuels present difficult problems in combustion (because of the high organically-bound nitrogen in the fuel), and materials (because of the trace metal contaminant levels in the fuels, leading to corrosion and deposition in the turbine hot

section). The combustion task includes (1) an effort to model the rich-lean combustion process, to predict NO/sub x/ emissions; (2) a two-stage flame tube experiment to study the effects of combustion operating conditions and fuel properties on NO/sub x/ conversion; and, (3) scaled combustor tests to evaluate the NO/sub x/-reduction potential of several staged-combustion concepts. The materials-corrosion resistance effort attacks the problem on three sides. 14 refs.

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13836 (DOE/SF/10538—T3) Evaluation of the Steinmueller-desulfurization process for coal-fired utility boilers. Volume I. Straus, R.W.; von Bismarck; Fischer. (Galaxy, Inc., Washington, DC (USA)). Jan 1981. Contract AC03-79SF10538. 189p. NTIS, PC A09/MF A01.

L and C Steinmueller is currently developing a direct desulfurization process for utility boilers fired with pulverized bituminous coal. Based on a new concept of retrofit low NOX staged mixing burners. The approach is to add powdered calcium compounds to the combustion air. The calcium captures the sulfur during combustion in a low temperature zone of the flame to form a dry sulfate which is removed along with the fly ash in electrostatic precipitators or bag filters. Previous efforts to desulfurize bituminous coal by injection of calcium additives to the combustion process were unsuccessful because sintering of the additive and intensive slagging occurred in the radiant section of the boiler. These effects were attributed to high flame temperatures. During the last two years, new development work has started in Austria, Germany and the US. In Germany, the Rheinisch-Westfaelische Elektrizitaetswerke (RWE) will apply the process in a lignite-fired 300 MW generating station, where combustion temperatures can be kept well below 1200°C., a maximum temperature limiting a feasible application of the process. As Steinmueller's new concept of mixing burners provides a flame zone with temperatures around 1100°C., into which the calcium compounds can be injected via the combustion air, a direct desulfurization appears feasible also for pulverized coal boilers. Steinmueller is currently developing the process with a burner on a 3 MW scale. The development aims at meeting the new SO_2 emission standard of 650 mg SO_2/Nm^3 by installation of retrofit burners into existing power stations without modification of the boiler. This evaluation complies initial data on the process, its economy and its main strengths and weaknesses.

13837 (EPA—600/8-80-004) Research summary: controlling nitrogen oxides. Schaefer, M. (ed.). (Environmental Protection Agency, Washington, DC (USA). Office of Research and Development). Feb 1980. 26p. Environmental Protection Agency, Center for Environmental Research Information, Cincinnati, OH.

The magnitude of NO/sub x/ emissions from stationary and mobile sources in the US, the effects of NO/sub x/ emissions, and goals for reducing these emissions are briefly described. Technologies for reducing NO/sub x/ emissions are discussed, and individual research projects on this subject being performed by various Office of Research and Development Laboratories are listed. (LCL)

13838 (EPRI-CS—1683(Vol.1)) Studies on mathematical models for characterizing plume and drift behavior from cooling towers. Volume 1. Review of European research. Policastro, A.J.; Wastag, M. (Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 185p. NTIS, PC A09/MF A01.

This report reviews recent research on cooling-tower plume dispersion carried out in Germany, Switzerland and France. A large quantity of good-quality laboratory and field data are available which can aid in the validation and improvement of cooling-tower plume models. Laboratory data from Electricite de France (EDF) provide basic parametric information on plume dispersion from one, two, and four towers of natural-draft type. Visible plume field data from Gardanne, Luenen and Neurath (supplemented by ambient profiles and tower-exit measurements) provide, in total, 24 new data cases for use in model validation and improvement studies. Other data available include measurements at tower exit of liquid water emission rates, droplet-size spectra and temperature/velocity profiles. Profiles of velocity and temperature across the tower top at Neurath have revealed several distinct flow configurations depending on the wind speed at tower top. Existing European models for cooling-tower plume dispersion are reviewed. Two of the most popular models (KUMULUS and FOG) are tested with field data and found to perform on par with the better US models. A two-year climatological study at Niederaussem presented interesting information on the long-term physical and biological effects of the cooling towers. A study of bacterial emissions of cooling towers using waste water revealed no significant adverse effects at and in the vicinity of the cooling towers.

13839 (EPRI-CS—1683(Vol.2)) Studies on mathematical models for characterizing plume and drift behavior from cooling towers. Volume 2. Mathematical model for single-source (single-tower) cooling tower plume dispersion. Carhart, R.A.; Policastro, A.J.; Ziemer, S.; Haake, K.; Dunn, W. (Argonne National Lab., IL (USA); Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). Jan 1981. Contract W-31-109-ENG-38. 185p. NTIS, PC A09/MF A01.

An improved model for natural-draft cooling tower plumes from single towers is presented. The model was developed through careful study of the systematic behavior of existing laboratory and field data and systematic testing of theoretical assumptions commonly employed in available plume models. Major model assumptions include bent-over plume; different spreading rates for momentum, temperature, and moisture; and an empirical treatment for plume downwash. Unknown experimental coefficients in the model were determined through calibration of model predictions with single-phase laboratory and visible plume field data. The model was also verified with new data not used in the calibration process. Our model provides an improvement in theory and performance over existing models and provides a correct representation of plume behavior at large wind speeds. This model is expanded to treat multiple tower plumes in Vol. 4.

13840 (EPRI-CS—1683(Vol.3)) Studies on mathematical models for characterizing plume and drift behavior from cooling towers. Volume 3. Mathematical model for single-source (single-tower) cooling tower drift dispersion. Dunn, W.E.; Gavin, P.; Boughton, B.; Policastro, A.J.; Ziebarth, J. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering; Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 249p. NTIS, PC A11/MF A01.

This report presents a new salt-drift deposition model for single natural-draft cooling towers which has the advantages of improved theory and good performance with field data. Advantages to the model include: a submodel for cooling-tower plume rise which has been calibrated and validated with laboratory and field data; improved treatment of droplet evaporation which accounts for salt-concentration gradients within the drop; and an option to employ a new drop breakaway criterion which allows a more continuous transition between plume and ambient environments for the drop. The drift model performs well in terms of comparisons made of predictions to 1977 Chalk Point Dye Study data. Those data include measurements of sodium deposition flux, average diameter, number drop deposition flux, and liquid deposition flux at downwind distances of 0.5 and 1.0 km. The model is untested for distances greater than 1.0 km due to the lack of good-quality field data at those distances. The model was developed as an improvement over existing theories which are evaluated theoretically and tested with Chalk Point data in this report. Sensitivity studies are presented which provide considerable insight as to the differences among existing formulations for droplet evaporation and droplet breakaway methods.

13841 (EPRI-CS—1683(Vol.4)) Studies on mathematical models for characterizing plume and drift behavior from cooling towers. Volume 4. Mathematical model for multiple-source (multiple-tower) cooling tower plume dispersion. Policastro, A.J.; Carhart, R.A.; Wastag, M. (Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 165p. NTIS, PC A08/MF A01.

This volume presents a generalization of our single source model (presented earlier in Volume 2) to multiple sources. The gen-

eralized model can treat vapor plume dispersion from any number of cooling towers in any geometrical configuration in any orientation to the direction of the wind. Important characteristics of the model include: (1) methodology of plume merging which accounts for differing plume entrainment rates during merging depending on wind direction; and (2) treatment of the effects of tower downwash from multiple towers; namely, additional entrainment and an additional pressure drag force acting vertically. Limited calibration of the model to laboratory data was undertaken to determine two downwash coefficients. Verification of the model by comparing model predictions to new lab and field data revealed a superior performance of our model as compared to the models commonly used in environmental impact evaluation. The ANL multiple-source model predicts visible plume height within a factor of 2 and/or visible plume length within a factor of 2 1/2 in 80% of our field data test cases. For comparison, the Orville and Slawson-Wigley Models satisfy this criterion for only 67% and 49% of the time, respectively. Additional ANL Model improvement is possible mainly through further development of the plume merging criterion.

13842 **(LA—8660-MS) Environmental assessment of trace elements from coal combustion in the semi-arid west. Progress summary report for FY 1976-1979.** Wangen, L.E.; Dreesen, D.R. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 23p. NTIS, PC A02/MF A01.

The results of research during FY 1976, FY 1976A, FY 1977, and FY 1979 under terms of the Interagency Energy/Environment Agreement are summarized. Trace element studies have been centered around the coal-fired Four Corners Power Plant located on the Navajo Reservation in northwestern New Mexico, which forms an integral part of the energy-rich Colorado Plateau region. The overall objective of this research has been to assess environmental consequences of trace elements identified as potentially hazardous to arid western ecosystems. To this end the two major corollary goals are to: (1) identify potentially hazardous trace elements in stack emissions and assess their importance with respect to deposition onto surrounding terrain, and (2) to determine which elements are mobilized in the scrubber system and ash disposal ponds at the Four Corners Power Plant. Results of dry deposition calculations, trace element measurements in air particulate, soils, and vegetation are reported pursuant to the first goal. Trace elements extracted from fly ash, trace element measurements in influent and effluent waters of the power plant, and trace element concentrations in a specie of vegetation growing in these effluent water channels are reported pursuant to the second goal.

13843 **(PB—80-170764) Residual oxidants removal from coastal power plant cooling system discharges: field evaluation of SO_2 addition system. Final report January-November 1979.** Scheyer, K.; Houser, G. (TRW, Inc., Redondo Beach, CA (USA)). Mar 1980. 41p. NTIS, PC A03/MF A01.

The report gives results of an evaluation of the performance of a dechlorination system that uses SO2 to remove residual oxidants from chlorinated sea water in a power plant cooling system. Samples of unchlorinated, chlorinated, and dechlorinated cooling water were obtained at Pacific Gas and Electric's Potrero power plant in San Francisco. The samples were collected during 28 sampling periods--14 at flood tide and 14 at ebb tide--and analyzed for several chemical and physical constituents. An amperometric titrator was used for field analysis of total oxidant residual (TOR) and free oxidant residual (FOR). Analytical results, plant operating data, and laboratory experiments were used to evaluate the dechlorination system. Major conclusions include: (1) the dechlorination system studied showed effective removal of residual oxidants from chlorinated sea water used in the power plant cooling system; (2) the dechlorination system proved reliable (no measurable oxidant residual was found at the effluent outfall); and (3) due to the effectiveness of the dechlorination system in removing all measurable oxidant residual, average and maximum levels of dechlorination cannot be determined.

13844 **(PB—80-176811) EPA utility FGD survey: October-December 1979. Quarterly report, October-December 1979.** Smith, M.; Melia, M.; Gregory, N. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Jan 1980. 571p. NTIS, PC A24/MF A01.

This report is the first full compilation (not a supplement) since the December 1978-January 1979 report. Because the next three reports are to be supplements, this issue should be retained for reference throughout the year. The report, which is generated by a computerized data base system, presents a survey of utility flue gas desulfurization (FGD) systems in the U.S. and Japan. It summarizes information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms. Systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process and waste disposal practice. It presents data on boiler design, FGD system design, fuel characteristics, and actual performance. It includes unit by unit dependability parameters and discusses problems and solutions associated with the boilers and FGD systems. Process flow diagrams and FGD system economic data are appended to the report.

13845 **(PB—80-177603) Effects of pathogenic and toxic materials transported via cooling device drift - Volume 1. Technical report. Final report, January 1977-September 1979.** Freudenthal, H.D.; Rubenstein, J.E.; Uzzo, A. (H 2 M Corp., Farmingdale, NY (USA)). Nov 1979. 218p. NTIS, PC A10/MF A01.

The report describes a mathematical model that predicts the percent of the population affected by a pathogen or toxic substance emitted in a cooling tower plume, and gives specific applications of the model. Eighty-five pathogens (or diseases) are cataloged as potentially occurring in U.S. waters, but there is insufficient data to predict the probability of occurrence or relate their occurrence to public health, population, or pollution. Sixty-five toxic substances are cataloged as potentially occurring in U.S. waters, but the actual number is probably many times the EPA-supplied list. Toxic concentrations to persons, animals, and plants are known for only a few of the chemicals: most toxic levels can be only inferred from animal studies. In the population as a whole, the epidemiological impact of a pathogen is a function of age, sex distribution, racial (genetic) distribution, general health and well-being, prior exposure, and immunological deficiency states. While cooling device drift may not be directly responsible for epidemics, it may potentiate the burden in an already weakened population, raising a segment of the population into the clinical state. The effect of toxic substances is difficult to evaluate because of inadequate data on humans. The effect is a function of concentration in susceptible tissue, and is much less dependent than pathogens on host resistance.

13846 **(PB—80-177611) Effects of pathogenic and toxic materials transported via cooling device drift. Volume 2. Appendices. Final report, January 1977-September 1979.** Freudenthal, H.E.; Rubenstein, J.E.; Uzzo, A. (H 2 M Corp., Farmingdale, NY (USA)). Nov 1979. 359p. NTIS, PC A16/MF A01.

The report describes a mathematical model that predicts the percent of the population affected by a pathogen or toxic substance emitted in a cooling tower plume, and gives specific applications of the model. Eighty-five pathogens (or diseases) are cataloged as potentially occurring in U.S. waters, but there is insufficient data to predict the probability of occurrence or relate their occurrence to public health, population, or pollution. Sixty-five toxic substances are cataloged as potentially occurring in U.S. waters, but the actual number is probably many times the EPA-supplied list. Toxic concentrations to persons, animals, and plants are known for only a few of the chemicals: most toxic levels can be only inferred from animal studies. In the population as a whole, the epidemiological impact of a pathogen is a function of age, sex distribution, racial (genetic) distribution, general health and well-being, prior exposure, and immunological deficiency states. While cooling device drift may not be directly responsible for epidemics, it may potentiate the burden in an already weakened population, raising a segment of the population into the clinical state. The effect of toxic substances is difficult to evaluate because of inadequate data on humans. The effect is a function of concentration in susceptible tissue, and is much less dependent than pathogens on host resistance.

13847 **(PB—80-180839) Energy facility siting workshops. Summary report.** Cambon, J. (Mitre Corp., McLean, VA (USA). METREK Div.). Jun 1978. 94p. NTIS, PC A05/MF A01.

This document summarizes the presentations and discussions addressed at a series of meetings and workshops on energy facility sitings held by the MITRE Corporation under the sponsorship of the National Science Foundation/Policy Research and Analysis Division. The following meetings and workshops are included: Increasing Efficiency and Effectiveness in Electrical Power Generation, Electric Utility Financial Problems and Potential Solutions; Second Meeting of Advisory Committee on Energy Facility Siting; Third Meeting of Advisory Committee on Energy Facility Siting; The Evolving Structure of the Electric Utility Industry; Long Run Energy Demand; Institutional Alternatives for LMFBR Development and Commercialization; Public Participation in Energy Related Decision-Making; and Public Policy Issues in Nuclear Waste Management.

13848 **(PB—80-181159) Sulfur oxides control in Japan.** Beek, C.R.; Rohse, B. (Environmental Protection Agency, Washington, DC (USA). Office of Research and Development). Nov 1979. 28p. NTIS, PC A03/MF A01.

Sulfur oxides are generated from the burning of fossil fuels. In Japan the major source of SO2 pollution is from the burning of heavy fuel oil by the electric power generating plants. The primary methods currently being practiced to control this pollution are flue gas desulfurization (FGD) and burning low sulfur fuels. To evaluate these advances for their potential application in the U.S., the Environmental Protection Agency organized an industry/government task force to visit Japan to obtain first hand information on their experience with FGD systems. The task force members' observations during that trip, their prior knowledge, and information gathered from referenced sources comprise this report. The first section provides an overview of the: Japanese energy status, SO2 pollution emissions control regulations, The general status of FGD applications in the industrial and utility sectors, Comparison of Japanese and U.S. experience. The second section provides detailed technical information on selected FGD installations visited including plant/FGD specifications, performance information and process flow diagrams. An appendix provides further information concerning members of the visiting task force, a listing of plants visited, and numbers and capacities of FGD systems in Japan.

13849 **(PB—80-181225) Characterization of scrubbed and unscrubbed power plant plumes: three case studies. Final report.** Stith, J.L.; Blumenthal, D.L.; Anderson, J.A. (Meteorology Research, Inc., Santa Rosa, CA (USA)). Mar 1980. 76p. NTIS, PC A05/MF A01.

Airborne measurements of scrubbed and unscrubbed emissions from the Widows Creek Power Plant were carried out during August 17-25, 1978. The results of the analysis of the measurements taken during three case study days are described.

13850 **(PB—80-187842) Sulfur dioxide oxidation in scrubber systems. Final report Jul 77-Jun 79.** Hudson, J.L. (Virginia Univ., Charlottesville (USA). Dept. of Chemical Engineering). Apr 1980. 257p. NTIS, PC A12/MF A01.

The report relates the liquid-phase oxidation kinetics of bisulfite and sulfite anions (determined in bench scale experiments) to conditions representative of limestone scrubbers used for flue gas desulfurization. The chemical reaction rates were determined for clear solutions and slurries of calcium sulfite when gas-to-liquid transfer of oxygen was not a limiting resistance. From the experimental results, a mathematical model was developed for the overall oxidation rate of calcium sulfite slurries, including solids dissolution and chemical reaction. The overall rate is shown to decline with increasing pH due to the reduced solubility of calcium sulfite; the solid dissolution rate is thus the limiting factor at high pH. The homogeneous chemical oxidation rate is 1.5 order and increases with pH. Organic acids inhibit the oxidation reaction, especially glyolic acid. Manganese and iron catalyze the oxidation reaction even in the presence of organic inhibitors.

13851 **(PB—80-188824) Lime fgd systems data book. Final report Dec 76-Dec 78.** Ponder, T.C. Jr.; Hartman, J.S.; Drake, H.M.; Kleir, R.P.; Master, J.S. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Apr 1979. Contract EPA-68-02-2603. 727p. NTIS, PC A99/MF A01.

The Data Book is intended to aid engineers in understanding the process design features that are unique to lime flue gas desulfurization (FGD) systems. It is intended to supplement, not replace, basic information on engineering design. It is addressed to engineers who must design, evaluate, or operate lime FGD systems. The information may also be useful to persons who are familiar with utility operations, but unfamiliar with chemical operations. The Data Book covers the entire process of lime-based FGD. The gas-side battery limits extend from the discharge of the steam generator to the discharge of the stacks. The absorbent-side battery limits extend from receipt of the lime to sludge discharge to the final sludge disposal site.

13852 **(PB—80-190051) Preliminary economic analysis of a lime spray dryer FGD system. Preliminary report May 79-Feb 80.** Burnett, T.A.; O'Brien, W.E. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Div. of Energy Demonstrations and Technology). Mar 1980. 75p. NTIS, PC A04/MF A01.

The report gives results of a preliminary economic analysis of two flue gas desulfurization (FGD) processes (one dry and one wet) for a new 500-MW power plant burning Western coal having 0.7% sulfur, 9.7% ash, and a heating value of 9700 Btu/lb and meeting current new source performance standards (70% SO2 removal and 0.03 lb/MBtu particulate emission). The generic lime spray-dryer process used a baghouse for particulate collection, while the wet limestone slurry process had an electrostatic precipitator (ESP) for particulate control. (In addition to the coal noted, the final report will include an economic evaluation for both low- and high-sulfur Eastern coals.)

13853 **(PB—80-190085) Environmental assessment of an oil-fired controlled utility boiler. Final report Jun 78-Dec 79.** Leavitt, C.; Arledge, K.; Shih, C.; Orsini, R.; Saur, A. (TRW, Inc., Redondo Beach, CA (USA)). Apr 1980. Contract EPA-68-02-2613. 91p. NTIS, PC A05/MF A01.

The report gives results of a comprehensive emissions assessment of the Haynes No. 5 boiler during oil-firing. Levels 1 and 2 procedures were used to characterize pollutant emissions. Assessment results, in conjunction with assumed typical and worst case meteorological conditions, were used to estimate the environmental impact of emissions from this type of unit. Principal conclusions were: (1) the risk of violating NAAQS due to criteria pollutant emissions is low; (2) little adverse health effect is anticipated as a result of SO2, SO4 (--), and particulate emissions projected from widespread use of oil-fired units of the type tested; (3) the impact of trace element burdens in drinking water, plant tissue, soil, and the atmosphere is negligible; (4) the risk of plant damage due to criteria pollutant emissions is remote; (5) the likelihood of plant damage due to trace element emissions is remote.

13854 **(PB—80-193220) Status of commercially important bivalves near the proposed Church Creek Power Plant site. Special report.** Becker, D.S.; Kaufman, L.S. (Johns Hopkins Univ., Baltimore, MD (USA). Chesapeake Bay Inst.). Sep 1979. 22p. NTIS, PC A02/MF A01.

This report is an assessment of the status of commercially important bivalve molluscs near the proposed Church Creek Power Plant intake/discharge site. Data on the soft-shell clam (Mya arenaria) and the oyster (Crassostrea virginica) were obtained from surveys using a commercial clam dredge, a diver-operated suction sampler, visual reconnaissance, and records. Young soft-shell clams were virtually absent, and other infaunal bivalves were present at relatively low abundance. The maximum density of marketable soft-shell clams was 16 bushels per acre, too low for commercial exploitation. Adult soft-shell clams were apparently less abundant in deeper water. This reduces the likelihood that commercial densities of soft-shell clams or oysters will occur naturally at this location in the future.

13855 **(PB—80-193238) A bathymetric survey of the proposed Church Creek Power Plant site. Special report.** Becker, D.S.; Conte, J.A.; Kaufman, L.S. (Johns Hopkins Univ., Baltimore, MD (USA). Chesapeake Bay Inst.). Jun 1979. 14p. NTIS, PC A02/MF A01.

This report presents the results of a bathymetric survey carried out off Taylors Island, Maryland in the vicinity of the proposed Church Creek Power Plant Site. Depth contours (corrected

for tidal height) at intervals of 2 feet are presented for depths between 6 and 40 feet. The original data are available on magnetic tape if better resolution is desired.

13856 **(PB—80-193246) Herpetological survey of the proposed expansion site for Vienna Steam Electric station, Vienna, Dorchester County, Maryland. Special report.** Johnson, R.H.; Deusen, M.V. (Johns Hopkins Univ., Baltimore, MD (USA). Chesapeake Bay Inst.). Sep 1979. 22p. NTIS, PC A02/MF A01.

This report presents the results of a herpetological survey conducted in the vicinity of the Vienna Steam Electric Station, Dorchester County, Maryland. Chicone Creek, which forms the eastern boundary of the site, does offer much habitat for reptiles and amphibians. Of the 24 species of reptiles and 17 species of amphibians reported from Dorchester County, 9 species of reptiles and 8 amphibians were observed during this study.

13857 **(PB—80-193253) Air pollution control device configurations. Consultant report (final).** (Acurex Corp., Mountain View, CA (USA)). Mar 1980. 48p. NTIS, PC A03/MF A01.

This report presents an analysis of those candidate air pollutant abatement schemes identified previously by Acurex Corporation in the report 'Environmental Control Technologies for a Northern California Coal-Fired Power Plant' (300-039) for possible use on PGandE's proposed Montezuma 1 and 2 (previously called Fossil 1 and 2) electric generating plants. Emphasis is placed on the effects of the arrangement of the control components, namely the baghouse, selective catalytic reduction (SCR) and flue gas desulfurization (FGD) units. Three basic configurations were identified as workable arrangements. The configurations were analyzed with respect to their capital, operating and maintenance cost impacts, reliability implications, and overall system removal efficiencies. Since there is no actual experience reported for these configurations with coal-fired boilers, reliability and overall efficiency estimates were described qualitatively.

13858 **(PB—80-196850) Stack gas reheat evaluation. Final report, June 1977-February 1980.** Menzies, W.R.; Muela, C.A.; Behrens, G.P. (Radian Corp., Austin, TX (USA)). Mar 1980. Contract EPA-68-02-2642. 315p. NTIS, PC A14/MF A01.

The report gives results of technical and economic evaluations of stack gas reheat (SGR) following wet flue gas desulfurization (FGD) for coal-fired power plants. The evaluations were based on information from literature and a survey of FGD users, vendors, and architect/engineer (A/E) firms. The report summarizes SGR processes and their features and their commercial operating experience. It addresses benefits and energy requirements associated with SGR, and describes a developed method for estimating reheat costs. SGR can protect equipment downstream of a wet scrubber from corrosion, reduce the potential for acid rainout near the plant stack, preclude visible stack plumes, and reduce ground-level pollutant concentrations by increasing plume buoyancy.

13859 **(PB—80-204241) EPA alkali scrubbing test facility: advanced program - final report (October 1974-June 1978).** Burbank, D.A.; Wang, S.C. (Bechtel National, Inc., San Francisco, CA (USA)). May 1980. Contract EPA-68-02-1814. 385p. NTIS, PC A17/MF A01.

The report summarizes results of advanced testing (from October 1974 through June 1978) of 30,000-35,000 acfm (10 MW equivalent) lime/limestone wet scrubbers for SO_2 and particulate removal at TVA's Shawnee power station. Reliable scrubber and mist eliminator operations were demonstrated. It is shown that the mist eliminator is much easier to keep clean when the scrubber is operated under conditions giving high alkali utilization. Mathematical models were developed for predicting SO_2 removal in limestone, lime, and magnesium-enhanced lime/limestone scrubbers. Forced oxidation with two scrubber loops was developed on the venturi/spray tower system with limestone, lime, and limestone/MgO slurry. Bleed stream oxidation was successful only with limestone/MgO slurry. Forced oxidation with a single scrubber loop was developed on the TCA system with limestone slurry. Other test blocks included limestone type and grind, automatic limestone feed control, Ceilcote egg-crate packing in the TCA, and flue gas emission characterization.

13860 **(PB—80-813140) Remote sensing applied to environmental pollution detection and management. 1964-July 1980 (citations from the NTIS Data Base). Report for 1964-July 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Aug 1980. 192p. NTIS PC N01/MF N01.

Application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarian problems. (This updated bibliography contains 187 citations, 20 of which are new entries to the previous edition.)

13861 **IEC: streamlining the environmental control package.** Nesbit, W.; Giovanni, D. *EPRI (Electric Power Research Institute) Journal ;* **5**: No. 10, 14-19(Dec 1980).

Integrated emission control (IEC) systems should lower the capital and operating costs of power-plant pollution-control equipment from its present level of 40% of total plant cost. The new IEC systems are no longer considered as plant additions, but are an integral design component. A pilot-plant test facility operated by the Electric Power Research Institute (EPRI) uses coal, which will continue to increase its position as the major fuel for power generation. The IEC approach offers advantages in siting, plant flexibility and reliability, and lower costs for environmental control. The EPRI test facility is comparing five basic equipment configurations: baghouse and wet scrubber, precipitator with a wet scrubber, a baghouse or precipitator with a spray dryer, a baghouse or precipitator with dry sorbent injection upstream of the baghouse, and a hot electrostatic precipitator with a wet scrubber. (DCK)

13862 **Protecting fish from cooling-system effects.** Hopkinson, J.; Murarka, I. *EPRI (Electric Power Research Institute) Journal ;* **5**: No. 10, 20-23(Dec 1980).

Electric Power Research Institute (EPRI)-sponsored research is looking for ways to moderate the effects of thermal pollution from electric power plant cooling systems on nearby aquatic ecosystems. The aim is to design the cooling-water intake and discharge systems so that they are beneficial rather than harmful to the environment. Conventional intake systems impinge large organisms on the screens, while smaller organisms are entrained in the intake water. The biofouling and scaling that results causes engineering as well as ecological problems and reduces plant efficiency. Designs to minimize these effects include porous dike intakes. Warm water can be used to boost fish production in hatcheries and food production in greenhouses and adjacent fields. A research program at the Oak Ridge National Laboratory is monitoring and measuring the stresses in a simulation system. More study is needed to determine the long-range effects, however. (DCK)

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 14208, 14239

13863 **(NCEI—0026) Voltage control and loss reduction on radial distribution feeders. Final report.** Grainger, J.J.; Lee, S.H. (North Carolina State Univ., Raleigh (USA). Dept. of Electrical Engineering). 1979. 111p. NTIS, PC A06/MF A01.

A new scheme for the control of radial distribution feeders is described. This control scheme is developed for implementation by an on-line, substation-based computer. The control objectives are the minimization of radial feeder losses of energy and power while adhering to a specified voltage schedule along the feeders. Control is exercised through reactive power controllers in the form of tap-changing transformers, voltage regulators and shunt-connected static capacitors. Varying load conditions have been simulated to demonstrate the manner in which the control scheme operates. The data needs for the control scheme are identified and it is shown

how, with a proper data bank, the control scheme can be implemented.

13864 **(PB—80-195027) Analysis of expansion of the Pacific Northwest-Southwest intertie system. Contractor report (final).** (Beck (R.W.) and Associates, Sacramento, CA (USA)). Apr 1980. 277p. NTIS, PC A13/MF A01.

Three proposals were reviewed for expanding transmission capacity between the Pacific Northwest and Southwest by 4300 MW (compared to the 3900 MW of existing line capacity) using currently available information. Additional studies and investigations are required to further define benefits and costs, but it appears that at least 2400 MW of additional interconnection is economically justified given current fuel costs of oil, coal, and nuclear generation, and ignoring likely future fuel cost escalation.

13865 **(PB—80-212673) Evaluation of health and environmental effects of extra high voltage (EHV) transmission. Final report.** (Office of Radiation Programs, Washington, DC (USA). Surveillance and Emergency Preparedness Div.). Jun 1980. 254p. NTIS, PC A12/MF A01.

In March 1975 to respond to concerns about the possible adverse health and environmental effects of Extra High Voltage (EHV) transmission lines, the Environmental Protection Agency requested data and information from the public (through a Federal Register Notice) on the health and environmental effects of 60 Hz transmission lines energized at 700 kV or higher. A review and analyses of more than 50 replies totaling over 6,000 pages is presented in this document.

13866 **(PB—80-808967) Extra high voltage power transmission. 1970-April, 1979 (citations from the NTIS data base). Report for 1970-April 1979.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 78p. NTIS PC N01/MF N01.

The design, construction and use of extra high voltage power transmission lines are discussed in the cited abstracts. Both underground and overhead lines are covered, as well as superconducting and resistive cryogenic lines. Health, safety and psychological aspects of the electric field, corona, ozone and acoustic effects of these lines are mentioned. New conductor, insulator, mounting, monitoring, control, lightning protection and other aspects of EHV power transmission are delineated. (Contains 59 citations)

13867 **(PB—80-808975) Extra high voltage power transmission. 1974-April 1979 (citations from the Engineering Index Data Base). Report for 1974-April 1979.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 196p. NTIS PC N01/MF N01.

The design, construction and use of extra high voltage power transmission lines are discussed in the cited abstracts. Both underground and overhead lines are covered, as well as superconducting and resistive cryogenic lines. Health, safety and psychological aspects of the electric field, corona, ozone and acoustic effects of these lines are mentioned. New conductor, insulator, mounting, monitoring, control, lightning protection and other aspects of EHV power transmission are delineated. (Contains 194 citations)

13868 **(PB—80-809080) Inverter converters. 1970-April, 1980 (citations from the NTIS Data Base). Report for 1970-April 80.** Hippler, R. (New England Research Application Center, Storrs, CT (USA)). May 1980. 106p. NTIS PC N01/MF N01.

Cited works cover the field of electrical devices which convert direct to alternating current. Some of the applications discussed are motor and furnace drives, solar and wind generated electrical power conversion, variable-frequency devices for motor speed-control drives, and power frequency conversion devices. The components used in these devices, such as thyristors, SCRs, MOS devices, etc., and the associated circuitries, are described. (Contains 91 citations)

13869 **(PB—80-809098) Inverter converters. 1970-April 1980 (citations from the Engineering Index Data Base). Report for 1970-April 1980.** Hippler, R. (New England Research Application Center, Storrs, CT (USA)). May 1980. 118p. NTIS PC N01/MF N01.

Cited works cover the field of electrical devices which convert direct to alternating current. Some of the applications discussed are motor and furnace drives, solar and wind generated electrical power conversion, variable-frequency devices for motor speed-control drives, and power frequency conversion devices. The components used in these devices such as thyristors, SCRs, MOS devices, etc., and the associated circuitries, are described. (Contains 125 citations)

13870 **(PB—80-809106) Inverter converters. 1964-April 1980 (citations from the American Institute of Aeronautics and Astronautics, Inc.). Report for 1964-April 1980.** Hippler, R. (New England Research Application Center, Storrs, CT (USA)). May 1980. 109p. NTIS PC N01/MF N01.

Cited works cover the field of electrical devices which convert direct to alternating current. Some of the applications discussed are motor and furnace drives, solar and wind generated electrical power conversion, variable-frequency devices for motor speed-control drives, and power frequency conversion devices. The components used in these devices, such as thyristors, SCRs, MOS devices, etc., and the associated circuitries, are described. (Contains 104 citations)

13871 **Power transfer via fiber optics.** Robertson, M.M. (Sandia Lab, Albuquerque, NM). pp 216-221 of Proceedings of the electron components conference. Piscataway, NJ; IEEE (1980).

From Electronic component conference; San Francisco, CA, USA (28 Apr 1980).

The feasibility of transmitting power on optical fibers has been demonstrated. This involved converting electrical power to optical power, transmitting the optical power through an optical fiber, and then converting the optical power back to electrical power by means of photovoltaic cells. Xe arcs and laser diodes were used as optical sources and various GaAs and Si diodes were used as photovoltaic cells. 7 refs.

21 NUCLEAR POWER PLANTS

13872 **(DOE/PE/70278—T11) Alternative institutional arrangements for nuclear power.** Bussard, D. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 8p. NTIS, PC A02/MF A01.

This paper investigates how alternative organizations of nuclear power generation would effect the regulatory environment for nuclear power production, how it would effect financial constraints on new construction, and what governmental barriers to such reorganization exist.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 13998, 13999, 14002, 14035, 14036, 14037, 14039, 14040, 14041

13873 **(PNL-SA—8121) Thermal-mechanical properties of cracked UO_2 pellets.** Williford, R.E.; Mohr, C.L.; Lanning, D.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1980. Contract AC06-76RL01830. 7p. (CONF-801107—66). NTIS, PC A02/MF A01.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

A series of experiments (IFA-431, 432, 513, and 527) sponsored by the Fuel Behavior Research Branch of the USNRC are being irradiated in the Halden Boiling Water Reactor to better define LWR fuel behavior over the normal operating range of power reactor fuel rods. One fuel behavior variable of interest is the thermally induced cracking of UO_2 fuel pellets. The effects of pellet cracking on the effective thermal conductivity and elastic

moduli for the fragmented fuel were found to be primarily dependent on the free area in the r, θ plane of the fuel rod. The free area is defined as the area within the cladding inner surface that is not occupied by the fuel fragments themselves.

13874 **(PNL-SA—8576) Status of the USNRC/PNL Halden test IFA-432.** Bradley, E.R.; Cunningham, M.E.; Lanning, D.D.; Williford, R.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 16p. (CONF-800627—2). NTIS, PC A02/MF A01.

From Halden project conference; Halden, Norway (1 Jun 1980).

The NRC/PNL fuel assembly IFA-432 began irradiation in December 1975 and as of January 1980 had reached an assembly average burnup of 2120 GJ/kgU (24.5 GWd/MTM). The rods in this assembly are heavily instrumented and this has allowed a fairly thorough analysis of fuel behavior. The emphasis of the analysis has been to evaluate the observed changes in thermal/mechanical behavior. These changes are related to estimates of fuel density changes, fission gas release, and fuel cracking and relocation. The following conclusions have been reached concerning the irradiation of IFA-432. Based on analysis of steady-state and transient thermal data, the fuel in all rods is extensively cracked and relocated. Significant reductions in the effective fuel thermal conductivity have been deduced from the analysis of the transient thermal data.

13875 **(PNL-SA—8638) Interpretation of fuel centerline thermocouple response to reactor scrams.** Lanning, D.D.; Cunningham, M.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 20p. (CONF-800627—3). NTIS, PC A02/MF A01.

From Halden project conference; Halden, Norway (1 Jun 1980).

This report compares and contrasts fuel thermocouple scram responses from the low-burnup assemblies IFA-513 and IFA-505 and the high-burnup assembly IFA-432. Even on a qualitative basis it is observed that the IFA-432 thermocouple responses are sluggish relative to that of low-burnup counterparts in rods of equivalent thermal resistance and design/enrichment. By numerical analysis, it is concluded that this apparent sluggishness is due to thermocouple decalibration, and an estimate of the decalibration is made.

13876 **(SAND—81-0419C) Sandia LWR H_2 research programs.** Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 11p. (CONF-810120—6). NTIS, PC A02/MF A01.

From Workshop on the impact of hydrogen on water reactor safety; Albuquerque, NM, USA (26 Jan 1981).

The objectives of the research are to quantify the threat posed by hydrogen released during LWR accidents and to generate information procedures and equipment concepts which will prevent or mitigate that threat.

13877 **(UCRL—84167(Rev.1)) Preliminary results of thermal igniter experiments in H_2-air-steam environments.** Lowry, W. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). Jan 1981. Contract W-7405-ENG-48. 32p. (CONF-810120—3(Rev.1)). NTIS, PC A03/MF A01.

From Workshop on the impact of hydrogen on water reactor safety; Albuquerque, NM, USA (26 Jan 1981).

Thermal igniters (glow plugs), proposed by the Tennessee Valley Authority for intentional ignition of hydrogen in nuclear reactor containment, have been tested for functionability in mixtures of air, hydrogen, and steam. Test environments included 6% to 16% hydrogen concentrations in air, and 8%, 10%, and 12% hydrogen in mixtures with 30% and 40% steam fractions. All were conducted in a 10.6 ft^3 insulated pressure vessel. For all of these tests the glow plug successfully initiated combustion. Dry air/hydrogen tests exhibited a distinct tendency for complete combustion at hydrogen concentrations between 8% and 9%. Steam suppressed both peak pressures and completeness of combustion. No combustion could be initiated at or above a 50% steam fraction. Circulation of the mixture with a fan increased the completeness of combustion. The glow plug showed no evidence of performance degradation throughout the program.

13878 **THERMIT, a three-dimensional, two-fluid code for LWR transient analysis.** Kelly, J.E.; Kazimi, M.S. (Massachusetts Inst. of Tech., Cambridge). *Transactions of the American Nuclear Society ;* **34**: 893-894(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13879 **Relating surveillance capsule measurements to pressure vessel damage.** Carew, J.F.; Min, D.K.; Aronson, A.L. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 629-630(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13880 **Extrapolation of surveillance dosimetry information to predict pressure vessel fluences.** Wagschal, J.J.; Maerker, R.E.; Yeivin, Y. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 631-632(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13881 **Decommissioning a boiling water reactor nuclear power plant.** Oak, H.D.; Holter, G.M. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 741-742(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13882 **Design errors in nuclear power plants.** Moieni, P. (Univ. of California, Los Angeles); Apostolakis , G.; Cummings, G.E. *Transactions of the American Nuclear Society ;* **34**: 446-447(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

13883 **Pressurized water steam generators--problems and progress.** Green, S.J.; Steininger, D.A. (EPRI, Palo Alto, Calif). *American Society of Mechanical Engineers, [Paper] ;* No. 80-C2/NE-8, 1-13(1980).

The nuclear industry has had a variety of problems with steam generators. Most of the problems are associated with corrosion and mechanically-induced tube and tube support plate damage in the steam generator. This paper discusses the current steam generator designs, and the major utility industry effort underway to understand the causes of the problems and developing potential solutions for both existing and new designs. 40 refs.

13884 **TMI-2 radionuclide inventory and decay properties.** Wilson, W.B.; England, T.R. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 787-788(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13885 **Relative importance of attenuation and reactivity effects in explaining local and global BWR neutron noise.** Sweeney, F.J. (Oak Ridge National Lab., TN); Robinson, J.C. *Transactions of the American Nuclear Society ;* **34**: 802(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13886 **Two-phase-flow instrumentation development at Brookhaven National Laboratory.** Jones, O.C. Jr. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 76-77(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13887 **Merits of a PWR with a natural uranium reflector.** Witzig, W.F.; Huang, P. (Pennsylvania State Univ., University Park). *Transactions of the American Nuclear Society ;* **34**: 437-438(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13888 **Evaluation of neutron monitors for PWR containment environments.** Sanna, R.S. (DOE, New York, NY); Hajnal, F.; Ryan, R. *Transactions of the American Nuclear Society ;* **34**: 624-625(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13889 **Fatigue crack growth of irradiated pressure vessel steels in simulated, reactor-grade water environment.** Cullen, W.H.; Watson, H.E.; Provenzano, V. (Naval Research Lab., Washington, DC). *Transactions of the American Nuclear Society ;* **34**: 182-183(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2103 Power Reactors, Non-breeding, Graphite Moderated

13890 **Fission product Pd-SiC interaction in irradiated coated particle fuels.** Tiegs, T.N. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 205-206(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

13891 **Characteristics of vortex-contained UF_6 gas in a beryllium-reflected reactor.** Barton, D.M. (Los Alamos Scientific Lab., NM); Jarvis, G.A.; Martin, E.R.; Kendall, J.S.; Jaminet, J.F.; Rodgers, R.J. *Transactions of the American Nuclear Society ;* **34**: 816-817(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13892 **Critical UF_6 cavity reactor experiments.** Jaminet, J.F. (United Technologies Research Center, East Hartford, CT); Barton, D.M. *Transactions of the American Nuclear Society ;* **34**: 814-816(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13893 **Feedback coefficients in the NASAP HWR.** Mallen, A.N.; Ludewig, H.; Cerbone, R.J. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 785-786(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 13960, 13962, 13963, 13983, 14004, 14014, 14018, 14022, 14025, 14026, 14027, 14028, 14029, 14045, 14046, 14047, 14048, 14049, 14050, 14051, 14052, 14053, 14054, 14055, 14057, 14058, 14059, 14060, 14061, 14062, 14063, 14064, 14065, 14066, 14067, 14068, 14069, 14070, 14071

13894 **(COO—2458-30) Utilization of continuous slowing down theory in conjunction with conventional spatial calculations.** Buckler, J.M.; Becker, M. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering). 1979. Contract AS02-76ET37230. 49p. NTIS, PC A03/MF A01.

The separable kernel analogy is used to develop a mechanism to utilize generalized continuous slowing down theory in conventional types of methods for calculating space-dependent spectra. A particular transport code, DTF-IV is modified to operate efficiently based on continuous slowing down theory. It is demonstrated that major reductions in storage requirements are made possible. The modified code is applied to a set of idealized test problems and adapted benchmark problems that deals with the types of difficulties typically encountered in fast reactor analysis. In all cases, good results are achieved both for spectra and for collapsed few-group constants.

13895 **(DLCS—5000380) [Shippingport Atomic Power Station]. Quarterly operating report, third quarter 1980.** (Duquesne Light Co., Shippingport, PA (USA)). 1980. Contract AC11-76PN00292. 28p. NTIS, PC A03/MF A01.

At the beginning of the third quarter of 1980, the Shippingport Atomic Power Station was operating with the 1A, 1B, 1C, and 1D reactor coolant loops and the 1AC and 1BD purification loops in service. During the quarter, the Station was operated for Duquesne Light Company System grid including base load and swing load operation. Twelve (12) planned swing load operations were performed on the LWBR Core this quarter to complete the LWBR operating plan of fifty (50) during this operating phase. The Station was shutdown on September 12 for the Fall 1980 Shutdown and remained in this mode through the end of the quarter. The LWBR Core has generated 18,297.98 EFPH from start-up through the end of the quarter. There were no radioactive liquid discharges from the Radioactive Waste Processing System to the river this quarter. The radioactive liquid waste effluent line to the river remained blanked off to prevent inadvertent radioactive liquid waste discharges. During the quarter, approximately 0.001 curies of Xe 133 activity were released from the station. The radioactivity released from Shippingport Station is far too small to have any measurable effect on the general background environmental radioactivity outside the plant.

13896 **(DLCS—5000480) [Shippingport Atomic Power Station]. Quarterly operating report, fourth quarter 1980.** (Duquesne Light Co., Shippingport, PA (USA)). 1980. Contract AC11-76PN00292. 23p. NTIS, PC A02/MF A01.

At the beginning of the fourth quarter of 1980, the Shippingport Atomic Power Station remained shutdown for the normally planned semiannual maintenance and testing program, initiated September 12, 1980. Operational testing began on November 7. Maximum power was achieved November 28 and was maintained throughout the remainder of the quarter except as noted. The LWBR Core has generated 19,046.07 EFPH from start-up through the end of the quarter. During this quarter, approximately 0.000025 curies of Xe 133 activity were released from the station. During the fourth quarter of 1980, 1081 cubic feet of radioactive solid waste was shipped out of state for burial. These shipments contained 0.037 curies of radioactivity.

13897 **(NP—25304) Mass transfer of stainless steel in pumped sodium loops and its effect on microstructure.** Thorley, A.W.; Blundell, A.; Bardsley, J.A. (UKAEA Risley Nuclear Power Development Labs.). 1980. 16p. NTIS (US Sales Only), PC A02/MF A01.

Metallography and supporting analytical techniques have been used to study the corrosion and deposition behavior of steel material in two pumped figure-of-eight loops operating at oxygen levels of 10 and 25 ppM. Corrosion has been identified in the high temperature parts of the system and ferrite layer formation and the undercutting of steel surfaces through the formation of sodium chromite have been established in the maximum temperature and downstream positions respectively. The damaged surface layer consists of Fe-Ni particles which after removal by the flowing sodium deposit in the low temperature part of the loop.

13898 **(NP—25305) Corrosion of iron in sodium and the influence of alloying elements on its mass transfer behavior.** Thorley, A.W. (UKAEA Risley Nuclear Power Development Labs.). 1980. 19p. NTIS (US Sales Only), PC A02/MF A01.

The corrosion behavior of pure iron and certain iron-base alloys in sodium has been studied using simple pumped loops constructed in mild steel or stainless steel. In the mild steel loop, iron corrodes at the same rate under near-isothermal conditions as it

does in a more complicated loop with a larger ΔT. Determination of the oxygen level during the test showed that although the corrosion rate of iron is a function of oxygen level and has an oxygen power dependence of 2 the oxygen content of the sodium did not alter during the corrosion process.

13899 **(NP—25306) Observations on the carburisation of type 316 stainless steel foil in a low carbon activity sodium environment.** Thorley, A.W.; Jeffcoat, P.J. (UKAEA Risley Nuclear Power Development Labs.). 1981. 16p. NTIS (US Sales Only), PC A02/MF A01.

The carburisation of Type 316 stainless steel in a low carbon activity sodium environment has been studied utilising T.E.M. and S.T.E.M. techniques coupled with energy dispersive x-ray measurements. It has been found that the attainment of an equilibrium carbon level and associated microstructure within the steel is a complex process which cannot be simply described by carbon diffusion into the steel. The equilibrium carbide, when finally established, is given by the formula $Cr_{20}Fe_3C_6$ with a derived chemical carbon activity of 3.14×10^{-4} at 650°C.

13900 **(PNL—3563) Overview of tritium fast-fission yields.** Tanner, J.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Mar 1981. Contract AC06-76RL01830. 12p. NTIS, PC A02/MF A01.

Tritium production rates are very important to the development of fast reactors because tritium may be produced at a greater rate in fast reactors than in light water reactors. This report focuses on tritium production and does not evaluate the transport and eventual release of the tritium in a fast reactor system. However, if an order-of-magnitude increase in fast fission yields for tritium is confirmed, fission will become the dominant production source of tritium in fast reactors.

13901 **(WAPD-TM—1467) Swelling and gas release in oxide fuels during fast transients (AWBA Development Program).** Dollins, C.C. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Feb 1981. Contract AC11-76PN00014. 35p. NTIS, PC A03/MF A01.

The previously reported swelling and gas release model for oxide fuels has been modified to predict fission gas bahavior during fast temperature transients. Under steady state or slowly varying conditions it has been assumed in the previous model that the pressure caused by the fission gas within the gas bubbles is in equilibrium with the surface tension of the bubbles. During a fast transient, however, net vacancy migration to the bubbles may be insufficient to maintain this equilibrium. In order to ascertain the net vacancy flow, it is necessary to model the point defect behaviour in the fuel. This model is reported. Knowing the net flow of vacancies to the bubble, the bubble size, the diffusivity can be determined and the long range migration of the gas out of the fuel can be calculated. The model has also been modified to allow release of all the gas on the grain boundaries during a fast temperature transient.

13902 **(WAPD-TM—1475) Critical heat flux experiments in an internally heated annulus with a non-uniform, alternate high and low axial heat flux distribution (AWBA Development Program).** Beus, S.G.; Seebold, O.P. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Feb 1981. Contract AC11-76PN00014. 53p. NTIS, PC A04/MF A01.

Critical heat flux experiments were performed with an alternate high and low heat flux profile in an internally heated annulus. The heated length was 84 inches (213 cm) with a chopped wave heat flux profile over the last 24 inches (61 cm) having a maximum-to-average heat flux ratio of 1.26. Three test sections were employed: one with an axially uniform heat flux profile as a base case and two with 60 inch (152 cm) uniform and 24 inch (61 cm) alternating high and low heat flux sections. The third test section had a 2.15 inch (5.46 cm) section with a peak-to-average heat flux ratio of 2.19 (hot patch) superimposed at the exit end of the alternating high and low heat flux profile.

13903 **LWBR proof-of-breeding analytical support project.** Winsch, I.O.; Levitz, N.; Parks, J.; Cannon, T.; Lautermilch, H.; Deeken, P.; Brock, R.; Wach, C.; Nelson, R. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 852(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13904 **Experimental study of LMFBR thermal insulations.** Shiu, K.K. (Argonne National Lab., IL); Jones, B.G. *Transactions of the American Nuclear Society ;* **34**: 878-879(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13905 **Simple anisotropic turbulence model for flow in rod bundles.** Vanka, S.P. (Argonne National Lab., IL); Chen, C.J.; Sha, W.T.; Sehgal, B.R. *Transactions of the American Nuclear Society ;* **34**: 879-880(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13906 **Experimental and numerical thermal-hydraulic results from a 61-pin simulated LMFBR subassembly.** Rose, S.D.; Dearing, J.F.; Clapp, N.E.; Fontana, M.H.; Gnadt, P.A.; Montogmery, B.H.; Morris, R.H.; Wantland, J.L. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 880-882(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13907 **Simulation of the CRBR upper plenum under thermal stratification conditions.** Domanus, H.M.; Sha, W.T. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 884-887(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13908 **Experimental modeling of an LMFBR pool outlet plenum.** Yahalom, R.; Bennet, J. (General Electric Co., Sunnyvale, CA). *Transactions of the American Nuclear Society ;* **34**: 887-888(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13909 **Dynamic response of heat exchangers to flow and temperature perturbations.** Chan, K.C. (Argonne National Lab., IL); Yadigaroglu, G. *Transactions of the American Nuclear Society ;* **34**: 888-890(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13910 **Correlation of critical heat flux data - sodium-heated boiling water.** France, D.M.; Carlson, R.D.; Chiang, T.; Minkowycz, W.J. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 890-891(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

13911 **Configuration optimization of high-performance 1000-MW(e) oxide heterogeneous cores.** Su, S.F. (Argonne National Lab., IL); Orechwa, Y.; Barthold, W.P. *Transactions of the American Nuclear Society ;* **34**: 780-781(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13912 **Short-term irradiation of carbide fuel elements after sodium bond loss.** DeMuth, N.S.; Latimer, T.W.; Petty, R.L. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 206-207(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13913 **Metallic fuel cladding eutectic formation during postirradiation heating.** Seidel, B.R. (Argonne National Lab., Idaho Falls, ID). *Transactions of the American Nuclear Society ;* **34**: 210-211(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13914 **Compatibility studies of thorium-based metal fuels with candidate cladding alloys.** Tetenbaum, M.; Shinn, W.A.; Johnson, C.E. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 211-212(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13915 **Noncontact measurement of the elastic constants of plutonium at elevated temperatures.** Calder, C.A. (Oregon State Univ., Corvallis); Draney, E.C.; Wilcox, W.W. *Transactions of the American Nuclear Society ;* **34**: 212-213(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13916 **Apparent dose rate dependence of swelling in austenitic stainless steels.** Porter, D.L.; Hudman, G.D. (Argonne National Lab., Idaho Falls, ID). *Transactions of the American Nuclear Society ;* **34**: 230-231(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13917 **Oxidation behavior of SS316 and advanced alloy cladding in GCFR environment.** Acharya, R.T.; Langer, S. (General Atomic Co., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 231-232(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13918 **Core restraint implications of EBR-II reflector assembly bowing.** Kalinowski, J.E.; Baumgartner, A.J. (WARD, Madison, PA). *Transactions of the American Nuclear Society ;* **34**: 233-234(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13919 **Irradiated type 304 SS bend test ductility.** Garkisch, H.D. (WARD, Madison, PA). *Transactions of the American Nuclear Society ;* **34**: 235-237(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13920 **Design and operation of SLSF test trains.** Tebo, F.J.; Noland, R.A.; Folkrod, J.R.; Burelbach, J.P.; Carson, N.J. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 246-247(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13921 **Fuel pin rupture detection system.** Hoffman, M.A.; Meyers, S.C.; Kirchner, T.L. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 249-250(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13922 **Overview of the fast reactor fuels program.** Evans, E.A.; Cox, C.M.; Hayward, B.R.; Rice, L.H.; Yoshikawa, H.H. (Hanford Engineerg Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 252(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13923 **Breeder reactor fuel fabrication development overview.** Carlson, M.C.J. (Hanford Engineering Development Lab., Richland, WA); Yatabe, J.M.; McLemore, D.R.; Bennett, D.W.; Graham, R.A. *Transactions of the American Nuclear Society ;* **34**: 252-253(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13924 **Automated fabrication of reactor fuel.** Nyman, D.H.; McLemore, D.R.; Bennett, D.W.; Yatabe, J.M. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 253-254(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13925 **CDS role in the US LMFBR Program.** Longenecker, J.R. (Dept. of Energy, Washington, DC). *Transactions of the American Nuclear Society ;* **34**: 567(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13926 **Conceptual design study technical integrator role.** Cox, D.D. (Boeing Engineering and Construction Co., Seattle, WA). *Transactions of the American Nuclear Society ;* **34**: 567-569(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13927 **CDS plant reactor assembly and refueling systems.** Brunings, J. (Atomics International Div., Canoga Park, CA); Bass, J.; Dupen, C. *Transactions of the American Nuclear Society ;* **34**: 569(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13928 **Conceptual design study core design.** Davies, S.M.; Murata, R.E.; Talwar, B. (General Electric Co., Sunnyvale, CA). *Transactions of the American Nuclear Society ;* **34**: 569-571(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13929 **CDS primary and intermediate systems design.** Anderson, C.A. Jr. (WARD, Madison, PA). *Transactions of the American Nuclear Society ;* **34**: 571-572(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13930 **Mechanical interaction effects during compaction of a hexagonal core array.** Kalinowski, J.E. (WARD, Madison, PA); Hrico, G.J. *Transactions of the American Nuclear Society ;* **34**: 607-609(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2107 Regulation And Licensing

13931 **(NUREG—0690) U.S. Nuclear Regulatory Commission annual report (1979). Annual report, No. 5, 1 October 1978-30 September 1979.** (Nuclear Regulatory Commission, Washington, DC (USA)). 1980. 330p. NTIS, PC A15/MF A01.

The report highlights major NRC activities in fiscal year 1979 under headings which correspond with the various facets of the agency's statutory responsibility. Topics include the following: Accident at Three Mile Island; Reactor regulation; Materials regulation; Domestic safeguards; Waste management; Inspection and enforcement; State programs; International activities; Standards development; Regulatory research; Informing and involving the public; Proceedings and litigation; Administration and management.

13932 **(NUREG/CR—1258-(Vol.2)) Inspection methods for physical protection project: Annual report, March 1979 - February 1980.** Bradley, R.T.; Bowden, D.D.; Olson, A.W.; Rogue, F.; Savage, J.W. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). Jun 1980. 59p. NTIS, PC A04/MF A01.

This is the annual report to the U.S. Nuclear Regulatory Commission (NRC) of progress at Lawrence Livermore National Laboratory (LLL) during the first year of the Inspection Methods for Physical Protection project. This report details the activities of the first year of work that culminated in delivery of field-test drafts of new procedures for inspecting the physical protection systems at nuclear power reactor sites.

13933 **(NUREG/CR—1315) The feasibility of field evaluation of physical protection procedures.** Savage, J.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1980. 75p. NTIS, PC A04/MF A01.

In a task for the U.S. Nuclear Regulatory Commission (NRC) Office of Inspection and Enforcement (IE), the Lawrence Livermore Laboratory (LLL) has studied the feasibility of developing a methodology for field evaluation of physical protection procedures by IE physical protection inspectors, and has determined that such a methodology is feasible. A logic diagram was used to analyze physical protection procedures and identify the resources needed for their successful execution. The dependence of response procedures on the availability of resources and on the exercise of preparatory support procedures prior to need for response is discussed. The effects of plant conditions and external influences that affect procedure execution are also discussed. The need for specific compliance and adequacy reference requirements derived from the regulations and licensee approved plans is explained.

13934 **(NUREG/CR—1368) Development of a checklist for evaluating maintenance, test and calibration procedures used in nuclear power plants. Formal technical report 14 February 1979-14 March 1980.** Brune, R.L.; Weinstein, M. (Sandia National Labs., Albuquerque, NM (USA)). May 1980. 150p. NTIS, PC A07/MF A01.

The report describes the process for developing a checklist to be used by the U.S. Nuclear Regulatory Commission Office of Inspection and Enforcement (I and E) inspectors during their evaluation of maintenance, test and calibration procedures. The objective of the checklist is to aid inspectors in identifying procedural characteristics that can lead to human performance deficiencies. Five nuclear power plants were surveyed to obtain a sample of procedures and related information for human factors evaluation. Procedural deficiencies were identified. In addition, a human factors analysis of 988 LERs submitted during the period 1975 through 1978 was performed to identify the major categories of procedures-related personnel error. Checklist items aimed at correcting these errors were developed. The checklist and suggested methods of application are presented.

13935 **(NUREG/CR—1369) Procedures evaluation checklist for maintenance, test and calibration procedures. Technical report 14 Feb 79-14 Mar 80.** Brune, R.L.; Weinstein, M. (Sandia National Labs., Albuquerque, NM (USA)). May 1980. 28p. NTIS, PC A03/MF A01.

The report describes a checklist to be used by the U.S. Nuclear Regulatory Commission Office of Inspection and Enforcement (I and E) inspectors during their evaluation of maintenance, test and calibration procedures. The objective of the checklist is to aid inspectors in identifying procedural characteristics that can lead to human performance deficiencies. A human factors analysis of 988 LERs submitted during the period 1975 through 1978 was performed to identify the major categories of procedures-related personnel error. The checklist items are aimed at correcting these errors. Suggested methods of application are described. A companion document, Development of a Checklist for Evaluating Maintenance, Test and Calibration Procedures Used in Nuclear Power Plants, NUREG/CR-1368, SAND80-7053, describes how the checklist was developed.

13936 **(NUREG/CR—1385) Development of a 'good' physical protection plan - capability 73.45(b).** Bennett, H.A.; Olascoaga, M.T.; Bloedel, S.A. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1980. 230p. NTIS, PC A11/MF A01.

This report describes the development and documentation of a partial physical protection plan for a hypothetical facility. This work provides limited testing of the NRC Fixed-Site Physical Protection Upgrade Rule Design Guidance Compendium and of a methodology for evaluating physical protection system performance relative to the Upgrade Rule, 10 CFR Part 73.45.

13937 **Consolidated standard NQA-1, quality assurance program requirements for nuclear power plants.** Beer, G.A. (Consolidated Edison Co., New York, NY). *Transactions of the American Nuclear Society ;* **34**: 613-614(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 13894, 15168

13938 **Effects of a throughflow on the steady state and stability of a natural circulation loop.** Zvirin, Y. (EPRI, Palo Alto, Calif). *AIChE Symposium Series ;* **76**: 238-249(1980).

An investigation is presented of an open thermosyphon. In particular, the effects of the throughflow rate and the inlet temperature are studied. The loop consists of two vertical insulated branches, with a heat source at the bottom and a heat sink at the top. The throughflow is injected just downstream of the heat sink and the outlet is located just downstream of the heat source. A one-dimensional model is employed, where the only spatial coordinate runs around the circulation loop. The coupled conservation equations for mass, momentum, and energy are derived and solved to yield the steady-state natural circulation flow rate and the temperature distribution. These depend on a single system parameter, related to the Grashof number, and on the throughflow rate and inlet temperature. 17 refs.

13939 **Representative sampling in reactor data analysis.** Berte, F.J.; Filstein, E.L; Goldstein, R. (Combustion Engineering, Windsor, CT). *Transactions of the American Nuclear Society ;* **34**: 774-775(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13940 **Constrained sensitivity theory.** Greenspan, E.; Williams, M.L. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 823-824(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13941 **Development and verification of multicycle depletion perturbation theory.** White, J.R. (Union Carbide Corp., Oak Ridge, TN); Burns, T.J. *Transactions of the American Nuclear Society ;* **34**: 824-825(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2202 Components And Accessories

13942 **(CONF-8004145—1) Unavailability analysis of redundant safety systems.** Vaurio, J.K.; Sciaudone, D. (Argonne National Lab., IL (USA); Lowell Univ., MA (USA)). 1980. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01.

From Reliability conference for the electric power industry; Madison, WI, USA (29 Apr 1980).

Analytical equations have been obtained for the unavailabilities of redundant standby safety systems with components tested periodically. Test and repair contributions, hardware failures, human testing and repair errors as well as failures due to true demands have been taken into account. Equations have been derived for m-out-of-n systems ($1 \leqq m \leqq n \leqq 4$) with uniformly staggered, consecutive and random testing schemes. The equations have been used in a computer code, ICARUS, and applied to practical safety systems. The results are useful for optimizing the redundancy and testing and they illustrate the importance of human/testing errors and falures associated with true demands.

13943 **(LA-tr—80-34) German Standard Problem No. 4 (Superheated Steam Reactor-SRV 350, fluid-dynamics). Draft: protocol results.** (Los Alamos Scientific Lab., NM (USA)). Sep 1980. Translation of Entwurf: Ergebnisprotokoll. Deutsches Standard-Problem Nr. 4 (HDR-SRV 350, fluiddynamik). 14p. NTIS, PC A02/MF A01.

Information is presented concerning the feedwater pipe back-pressure valve.

13944 **(NUREG/CR—1274) Flaw preparations for HSST program vessel fracture mechanics testing: mechanical-cyclic pumping and electron-beam weld-hydrogen-charge cracking schemes.** Holz, P.P. (Oak Ridge National Lab., TN (USA)). Jun 1980. 67p. NTIS, PC A04/MF A01.

The purpose of the document is to present schemes for flaw preparations in heavy section steel. The ability of investigators to grow representative sharp cracks of known size, location, and orientation is basic to representative field testing to determine data for potential flaw propagation, fracture behavior, and margin against fracture for high-pressure-, high-temperature-service steel vessels subjected to increasing pressurization and/or thermal shock. Gaging for analytical stress and strain procedures and ultrasonic and acoustic emission instrumentation can then be applied to monitor the vessel during testing and to study crack growth. This report presents flaw preparations for HSST fracture mechanics testing. Cracks were grown by two techniques: (1) a mechanical method wherein a premachined notch was sharpened by pressurization and (2) a method combining electron-beam welds and hydrogen charging to crack the chill zone of a rapidly placed autogenous weld. The mechanical method produces a naturally occurring growth shape controlled primarily by the shape of the machined notch; the welding-electrochemical method produces flaws of uniform depth from the surface of a wall or machined notch. Theories, details, discussions, and procedures are covered for both of the flaw-growing schemes.

13945 **(NUREG/CR—1555) Critical experiments, measurements, and analyses to establish a crack-arrest methodology for nuclear-pressure-vessel steels. Progress report, June-December 1979.** Rosenfield, A.R.; Abou-Sayed, I.; Gillot, R.; Kanninen, M.F.; Jung, J. (Battelle Columbus Labs., OH (USA)). Jun 1980. 43p. NTIS, PC A03/MF A01.

Analyses of two kinds of crack arrest experiments have been carried out. The first case was a dynamic finite-difference analysis of tests on a photoelastic material carried out at the University of Maryland. Theory and experiments were shown to be in excellent agreement. The second case was a thermal-shock experiment (TSE-5) carried out by Oak Ridge National Laboratory. Agreement between theory and experiment was not as good here, possibly because the available data base was less detailed and because only an approximate dynamic analysis was carried out.

13946 **Transient response and thermal shock resistance of sheathed thermocouples.** Carroll, R.M.; Shepard, R.L. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 875-876(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13947 **Ion penetration distance calculations with multigroup transport computer codes.** Hoffman, T.J. (Union Carbide Corp., Oak Ridge, TN); Robinson, M.T.; Dodds, H.L. Jr.; Holmes, D.K. *Transactions of the American Nuclear Society ;* **34**: 224-226(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13948 **Detection of sensor failures in nuclear plants using analytic redundancy.** Kitamura, M. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 581-583(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13949 **Effects of neutron irradiation on fatigue crack propagation in austenitic stainless steels.** Michel, D.J. (Naval Research Lab., Washington, DC); James, L.A. *Transactions of the American Nuclear Society ;* **34**: 183(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2203 Fuel Elements

13950 **(LA—8699-PR) Fission product release. Progress report, July 1-September 30, 1980.** Norris, A.E. (comp.). (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 10p. (ONWI/Sub—80/E511-01200-8). NTIS, PC A02/MF A01.

An H.B. Robinson-2 spent fuel wafer was dissolved for radiochemical and mass spectroscopic determinations of the source terms for elements that have been leached from similar spent fuel wafers. The values for the 22 measured nuclides are presented on an atoms/g UO_2 basis. The interpretation of leach rate data plots is presented. Data interpretation appears to be most reliable when the incremental leaching rate is plotted against the mid-times of the leaching durations. When, instead, cumulative leach rates are plotted against cumulative leaching time, the leaching intervals should be in an invariant sequence.

13951 **(NUREG/CR—0588) Analysis of fuel relocation for the NRC/PNL Halden assemblies IFA-431, IFA-432, and IFA-513. Interim report.** Williford, R.E.; Mohr, C.L.; Lanning, D.D.; Cunningham, M.E.; Rausch, W.N. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RLO1830. 153p. NTIS, PC A08/MF A01.

The effects of the thermally-induced cracking and subsequent relocation of UO2 fuel pellets on the thermal and mechanical behavior of light-water reactor fuel rods during irradiation are quantified in this report. Data from the Nuclear Regulatory Commission/Pacific Northwest Laboratory Halden experiments on instrumented fuel assemblies (IFA) IFA-431, IFA-432, and IFA-513 are analyzed. Beginning-of-life in-reactor measurements of fuel center temperatures, linear heat ratings, and cladding axial elongations are used in a new model to solve for the effective thermal conductivity and elastic moduli of the cracked fuel column. The primary assumptions of the new model are that (1) the cracked fuel is in a hydrostatic state of stress in the (r,theta) plane, and that (2) there is no axial slipping between fuel and cladding. Three basic parameters are used to describe the cracked fuel: (1) the crack pattern, (2) the crack roughness, and (3) the fuel surface (gap) roughness. Recommendations are made on refining the model.

13952 **(ORNL/TM—7651) Production of spherical UO_2-UC_2 for nuclear fuel applications using thermochemical principles.** Stinton, D.P.; Lackey, W.J.; Spence, R.D. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 18p. NTIS, PC A02/MF A01.

A process for the fabrication of uranium dioxide-uranium dicarbide microspheres for use as an advanced nuclear fuel is described. The uranium-carbon-oxygen phase diagram was used extensively in applying thermochemical principles to the combined process of uranium carbide synthesis and kernel sintering. Variation of the partial pressure of carbon monoxide during the carbothermic reduction of urania plus carbon allowed the kernel composition and density to be controlled. X-ray diffraction, microstructural examination, and detailed chemical analyses were used to identify the kernel composition. A procedure was developed to convert urania

plus carbon microspheres produced by a wet-chemical gelation process to a highly dense UO_2-UC_2 product at 1550°C.

13953 **(PNL-SA—8639) Fabrication of ThO_2 and ThO_2-UO_2 fuel pellets.** Davis, N.C.; Matthews, R.B.; White, G.D.; Hart, P.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RL01830. 23p. (CONF-801034—9). NTIS, PC A02/MF A01.

From 33. ACS Pacific Coast meeting; San Francisco, CA, USA (28 Oct 1980).

In this presentation, ThO_2 and ThO_2-UO_2 pellet fuel development activities leading to the production of kilogram quantities of fuel are described. Conventional dry ball milling was used to produce ThO_2 and ThO_2-UO_2 mixtures that were pressed and sintered to 95% TD with a homogeneous distribution of the components.

13954 **Data acquisition and control for gamma scanning.** Barnes, B.K.; Murray, A.S.; Quintana, J.N. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 849-850(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13955 **Fittings for high-pressure burst testing of reactor component material.** Pasupathi, V. (Battelle Columbus Labs., OH); Smith, G.P.; Lowry, L.M.; Perrin, J.S. *Transactions of the American Nuclear Society ;* **34**: 850-852(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2204 Control Systems

13956 **(ALO—130) Development of quantitative risk acceptance criteria.** Griesmeyer, J.M.; Okrent, D. (California Univ., Los Angeles (USA). Dept. of Chemical, Nuclear, and Thermal Engineering). Jan 1981. Contract AS04-78ET35400. 54p. NTIS, PC A04/MF A01.

Some of the major considerations for effective management of risk are discussed, with particular emphasis on risks due to nuclear power plant operations. Although there are impacts associated with the rest of the fuel cycle, they are not addressed here. Several previously published proposals for quantitative risk criteria are reviewed. They range from a simple acceptance criterion on individual risk of death to a quantitative risk management framework. The final section discussed some of the problems in the establishment of a framework for the quantitative management of risk.

13957 **(EGG-SSDC—5288) Human factors engineering evaluation of the Advanced Test Reactor Control Room.** Boone, M.P.; Banks, W.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1980. Contract AC07-76ID01570. 114p. NTIS, PC A06/MF A01.

The information presented here represents preliminary findings related to an ongoing human engineering evaluation of the Advanced Test Reactor (ATR) Control Room. Although many of the problems examined in this report have been previously noted by ATR operations personnel, the systematic approach used in this investigation produced many new insights. While many violations of Human Engineering military standards (MIL-STD) are noted, and numerous recommendations made, the recommendations should be examined cautiously. The reason for our suggested caution lies in the fact that many ATR operators have well over 10-years experience in operating the controls, meters, etc. Hence, it is assumed adaptation to the existing system is quite developed and the introduction of hardware/control changes, even though the changes enhance the system, may cause short-term (or long-term, depending upon the amount of operator experience and training) adjustment problems for operators adapting to the new controls/meters and physical layout.

13958 **Automated pattern recognition system for noise analysis.** Sides, W.H. Jr. (Oak Ridge National Lab., TN); Piety, K.R. *Transactions of the American Nuclear Society ;* **34**: 720-722(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13959 **Experimental studies of control rod geometry and enrichment effects in ZPPR-10A.** Collins, P.J.; McFarlane, H.F.; Grasseschi, G.L. (Argonne National Lab., Idaho Falls, ID). *Transactions of the American Nuclear Society ;* **34**: 751-752(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13960 **Influence of control rod worth interactions on LMFBR control systems design.** Lake, J.A.; Rittenberger, R.V.; Rathbun, R.W. (Westinghouse Electric Corp., Madison, PA). *Transactions of the American Nuclear Society ;* **34**: 778-780(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13961 **PWR instrumentation: recommendations for improvement from TMI-2 experience.** Shepard, R.L.; Anderson, J.L. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 792-793(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13962 **Advanced absorber assembly design for breeder reactors.** Pitner, A.L.; Birney, K.R. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 606-607(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13963 **Design of absorber assemblies with intentional pellet/cladding mechanical interaction.** Hollenberg, G.W.; Birney, K.R.; Pitner, A.L. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 612(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 13847, 14021, 14719, 14784, 14785, 14786, 14863

13964 **(NUREG/CR—0989-EX-SUM) The visual aesthetic impact of alternative closed cycle cooling systems. Executive summary. Final report, January 1978-February 1980.** Currie, J.W. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Apr 1980. 25p. NTIS, PC A02/MF A01.

The objective was to produce a validated methodology that can provide timely predictions of the visual aesthetic impact on people viewing alternative closed cycle cooling systems on nuclear power plant landscapes. First, visual aesthetic impact (VAI) measure was defined. The VAI measure chosen was the maximum amount people would be willing to pay (WTP), or the minimum amount they would be willing to accept (WTA) in compensation, for visible changes on nuclear power plant landscapes. The next step was to collect the data required using 'bidding game' questionnaires to elicit respondents' WTP and WTA for visible differences between natural and mechanical draft cooling towers and plumes. Data were collected on VAI and other variables at six U.S. sites and analyzed to produce a statistical relationship between visual aesthetic impact and theoretically related variables.

13965 **Overview of beneficial uses of nuclear fission products.** Sivinski, J.S. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 334-335(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2206 Research, Test, And Experimental Reactors

13966 **(PNC-N—941-80-192) Production of analysis code for JOYO dosimetry experiment user's manual of neutron unfolding code (NEUPAC).** Sasaki, M.; Nakazawa, M.; Taniguchi, T.; Suzuki, S. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center; Tokyo Univ. (Japan)). Dec 1980. 159p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01.

Work performed under United States-Japanese Fast Reactor Exchange Program.

As part of the measurement and analysis plan for the Dosimetry Experiment at the JOYO experimental fast reactor, neutron flux spectra analysis is performed using the NEUPAC (Neutron Unfolding Package) computer program. The code calculates the neutron flux spectra and other integral quantities from the activation data of the dosimeter foils. The NEUPAC code is based on the J1-type unfolding method, and the estimated neutron flux spectra is obtained as its solution. This report presents the analytic theory, the program algorithms, and a description of the functions and use of the NEUPAC code.

13967 **US RERTR Program, its fuel development activities, and application in the KUHFR.** Travelli, A. (Argonne National Lab., IL); Stahl, D.; Shibata, T. *Transactions of the American Nuclear Society ;* **36**: 92-102(1981). (CONF-810233—).

From 3. Pacific Basin conference; Acapulco, Mexico (16 Feb 1981).

The goals, structure, and accomplishments to date of the Reduced-Enrichment Research and Test Reactor (RERTR) Program are described in detail. Plans and schedules for future program activities are outlined with the effect these activities may potentially have on the research reactor community. The fuel development activities of the program are discussed in detail, with particular emphasis on the new low-enrichment, high uranium density fuels the RERTR Program is developing for application in research reactors in the near future. The results of a joint study program between the RERTR Program and the Kyoto University Research Reactor Institute (KURRI), aimed at converting the Kyoto University High-Flux reactor (KUHFR) to the use of reduced-enrichment uranium, are presented.

13968 **S/sub n/ transport calculations of the PCA experiments with some estimated uncertainties.** Maerker, R.E. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 628-629(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13969 **FFTF project status.** Nolan, J.E.; McShane, W.J.; Noordhoff, B.H. (Westinghouse Hanford, Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 695-697(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13970 **FFTF sodium and cover-gas chemistry.** McCown, J.J.; Barton, G.B.; Bloom, G.R.; Meadows, G.E.; Mettler, G.W. (Westinghouse Hanford, Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 697-698(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13971 **FFTF heat transport system (HTS) component and system design.** Young, M.W.; Edwards, P.A. (Westinghouse Hanford, Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 698-699(1980). (CONF-800607—).

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13972 **FFTF plant utilization program.** Ziff, J.J. (Westinghouse Hanford, Richland, WA); Absher, K.R. *Transactions of the American Nuclear Society ;* **34**: 699-700(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13973 **FFTF utilization for irradiation testing.** Baum, P.W. (Dept. of Energy, Richland, WA); Keating, J.J.; Corrigan, D.C.; Krupar, J.J. *Transactions of the American Nuclear Society ;* **34**: 700-702(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13974 **FFTF pipe vibration testing and dimensional survey.** Lindquist, M.R. (Westinghouse Hanford, Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 702-703(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13975 **Surveillance and in-service inspection (SISI) program at FFTF.** Conrads, T.J. (Westinghouse Hanford, Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 703(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13976 **FFTF support facilities.** Arneson, S.O. (Westinghouse Hanford, Richland, WA); Burgess, C.A.; Rutkauskas, V.J.; Simonson, D.P. *Transactions of the American Nuclear Society ;* **34**: 703-706(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13977 **FFTF fuel loading and handling equipment.** Amerine, D.B. (Westinghouse Hanford, Richland, WA); Tollbom, L.R.; Danker, W.J. *Transactions of the American Nuclear Society ;* **34**: 707(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13978 **FFTF reactor system testing program results and overview.** Peckinpaugh, C.L. (Westinghouse Hanford, Richland, WA); Farabee, O.A. *Transactions of the American Nuclear Society ;* **34**: 707-709(1980). (CONF-800607—).

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13979 **Operations preparations for FFTF startup.** Moffitt, W.C. (Westinghouse Hanford, Richland, WA); Izatt, R.D. *Transactions of the American Nuclear Society ;* **34**: 709-711(1980). (CONF-800607—).

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13980 **FFTF auxiliary system testing program results and overview.** Bliss, R.J. (Westinghouse Hanford, Richland, WA); Hunter, J.R. *Transactions of the American Nuclear Society ;* **34**: 711-712(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13981 **Initial fuel load and criticality, zero power and characterization testing.** Bennett, R.A. (Westinghouse Hanford, Richland, WA); Jones, D.H.; Midgett, C.; Rathbun, J.L.; Farabee, O.A.; King, T.L. *Transactions of the American Nuclear Society ;* **34**: 712-713(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13982 **Instrumented fuel element design and performance with replaceable tungsten-rhenium thermocouples.** Schmidt, T.R.; Sasmor, D.J. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 749-750(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13983 Transport theory analyses of simulated LMFBR meltdown critical assemblies. McKnight, R.D.; Freese, K.E. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 752-754(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13984 Comparison of calculations and integral measurements for a uranium/iron benchmark critical assembly. Robinson, W.R.; DiIorio, G.J.; Morman, J.A.; Schaefer, R.W. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 754-755(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13985 Initial physics measurements on FFTF. Bennett, R.A. (Hanford Engineering Development Lab., Richland, WA); Daughtry, J.W.; Rothrock, R.B.; Harris, R.A.; Rathbun, J.L.; Zimmerman, B.D.; Jones, D.H.; King, T.L. *Transactions of the American Nuclear Society ;* **34**: 822-823(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13986 Manufacture of driver cladding tubes for FFTF. Inouye, J.J. (Carpenter Technology Corp., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 217-218(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13987 Fabrication of FFTF driver fuel duct tubes. Wozniak, D.R. (Carpenter Technology Corp., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 218-219(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13988 Fabrication of FFTF fuel pin wrap wire. Epperson, E.M. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 219-220(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13989 Welding reactor core components for the Fast Flux Test facility. Brown, W.F.; Boolen, R.F.; Miller, R.C.; McCord, R.B. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 220-221(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

13990 Fuel pin fabrication for the FFTF. Williams, J.F.; Rice, L.H. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 221-222(1980). (CONF-800607—).

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13991 Instrumented fuels test for FFTF. Feigenbutz, L.V.; Hoth, C.W. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 247-248(1980). (CONF-800607—).

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13992 FFTF in containment cell liner design and installation experience. Umek, A.M.; Swenson, L.D. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 610-611(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

2208 Propulsion Reactors

13993 Exhaust and evaporative emissions from alcohol and ether fuel blends. Naman, T.M.; Allsup, J.R. (US DOE, Bartlesville, Okla). *SAE Preprint ;* No. 800858, 1-11(1980).

An experimental study was conducted at the U.S. Dept. of Energy's Bartlesville (Okla.) Energy Technology Center to evaluate the effects of four potential fuel extenders (each blended with gasoline) on fuel economy, exhaust emissions, and evaporative emissions from eight 1978 automobiles (three with California emission controls and five with Federal emission control systems). 4 refs.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 13956, 13983, 14163, 14510, 14900

13994 Investigation of combined free and forced convection in a 2*6 rod bundle during controlled flow transients. Bates, J.M.; Khan, E.U. (Battelle, Pac Northwest Lab, Richland, Wash). *AIChE Symposium Series ;* **76**: 215-230(1980).

An experimental study was performed to obtain local fluid velocity and temperature measurements in the mixed (combined free and forced) convection regime for specific flow coastdown transients in an electrically heated 2*6 rod bundle cooled by water. The objective of the study was to develoμ an understanding of the thermal-hydraulic phenomena at low flows in a rod bundle subjected to lateral power skews and to develop a transient data base for evaluating themal-hydraulic computer programs. Test conditions included 150 second and 45 second flow coastdown transients, a Reynolds number range of 300 to 1300, and power skews of 1:0 and 2:1. A model incorporating the enhanced turbulent mixing due to thermal plume interactions was used to improve the COBRA-WC code predictions at large ratios of Gr/Re/sup 2/. A preliminary criterion was developed for the inception of recirculation within the bundle. 10 refs.

13995 (EPRI-NP—1305(Vol.1)) Analysis of steam chugging phenomena. Volume 1. Final report. Sargis, D.A.; Masiello, P.J.; Stuhmiller, J.H.; Wang, S.S. (JAYCOR, Alexandria, VA (USA)). Jan 1981. 141p. NTIS, PC A07/MF A01.

Thermalhydraulic models are presented to simulate steam chugging phenomena and are based on fundamental mass, momentum, and energy conservation laws. Computer codes have been written to describe random internal chugging, gas dynamics, and multivent phenomena in the downcomer pipes and supply lines, temperature distributions in the pool water, area changes and condensation rates at the moving free surface and response of the tank walls. Comparisons with experimental data are also presented.

13996 (EPRI-NP—1305(Vol.4)) Analysis of steam chugging phenomena. Volume 4. User's manual for the SAMPAC1 computer program. Final report. Wang, S.S.; Stuhmiller, J.H. (JAYCOR, Alexandria, VA (USA)). Jan 1981. 157p. NTIS, PC A08/MF A01.

Thermalhydraulic models are presented to simulate steam chugging phenomena and are based on fundamental mass, momentum, and energy conservation laws. Computer codes have been written to describe random internal chugging, gas dynamics, and multivent phenomena in the downcomer pipes and supply lines, temperature distributions in the pool water, area changes and condensation rates at the moving free surface and response of the tank walls. Comparisons with experimental data are also presented.

13997 (EPRI-NP—1692(Vol.1)) Heat transfer above the two-phase mixture level under core uncovery conditions in a 336-rod bundle. Volume 1. Andreychek, T.S. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Jan 1981. 141p. NTIS, PC A07/MF A01.

Twenty-two constant pressure boiloff, or core uncovery, tests were performed in the G-2 Loop test facility using a bundle of 336 heater rods. The parameters tested were vessel pressure and bundle power. For each test, temperatures at various axial positions within selected heater rods in the bundle and temperatures, pressures, differential pressures, and water levels at various locations

around the facility were taken and recorded. From the recorded data were calculated heater rod heat fluxes, steam flows, liquid carryover from the bundle, and rates of boiloff or core uncovery. These calculated data were used to evaluate the heat transfer process above the bundle two-phase mixture level under core uncovery conditions.

13998 **(NUREG/CR—0672-V-1) Technology, safety and costs of decommissioning a reference boiling water reactor power station. Volume 1. Main report. Technical report, September 1977-October 1979.** Oak, H.D.; Holter, G.M.; Kennedy, W.E. Jr.; Konzek, G.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 309p. NTIS, PC A14/MF A01.

Technology, safety and cost information is given for the conceptual decommissioning of a large (1100MWe) boiling water reactor (BWR) power station. Three approaches to decommissioning, immediate dismantlement, safe storage with deferred dismantlement and entombment, were studied to obtain comparisons between costs, occupational radiation doses, potential dose to the public and other safety impacts. It also shows the sensitivity of decommissioning safety and costs to the power rating of a BWR in the range of 200 to 1100 MWE.

13999 **(NUREG/CR—0672-V-2) Technology, safety and costs of decommissioning a reference boiling water reactor power station. Volume 2. Appendices. Technical report, September 1977-October 1979.** Oak, H.D.; Holter, G.M.; Kennedy, W.E. Jr.; Konzek, G.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. 702p. NTIS, PC A99/MF A01.

Technology, safety and cost information is given for the conceptual decommissioning of a large (1100MWe) boiling water reactor (BWR) power station. Three approaches to decommissioning, immediate dismantlement, safe storage with deferred dismantlement and entombment, were studied to obtain comparisons between costs, occupational radiation doses, potential dose to the public and other safety impacts. It also shows the sensitivity of decommissioning safety and costs to the power rating of a BWR in the range of 200 to 1100 MWE. This volume contains the appendices.

14000 **(NUREG/CR—1021) Models selected for calculation of doses, health effects and economic costs due to accidental radionuclide releases from nuclear power plants. Technical report.** Strenge, D.L.; Acharya, S.; Baker, D.A.; Droppo, J.G.; McPherson, R.B. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1980. 188p. NTIS, PC A09/MF A01.

Models are described for use in site-specific environmental consequence analysis of nuclear reactor accidents of Classes 3 through 9. The models presented relate radioactivity released to resulting doses, health effects, and costs of remedial actions. Specific models are presented for the major exposure pathways of airborne releases, waterborne releases and direct irradiation from activity within the facility buildings, such as the containment. Time-dependent atmospheric dispersion parameters, crop production parameters, and other variable parameters are used in the models. The environmental effects are analyzed for several accident start times during the year. Several remedial actions are considered.

14001 **(NUREG/CR—1072) A study of molten debris freezing and wall erosion in the RIA-ST-4 experiment.** El-Genk, M.S.; Moore, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Apr 1980. 58p. NTIS, PC A04/MF A01.

The safe containment of molten debris following a hypothetical core meltdown accident in a light water reactor depends on the postaccident distribution and freezing of the debris. The objective of the present work is to analyze the freezing of molten debris produced during a severe, in-pile reactivity initiated accident experiment, designated RIA-ST-4. A one-dimensional physical model is developed to study the transient freezing of a molten debris layer deposited on the inner surface of the RIA-ST-4 coolant flow shroud wall and to assess the potential for wall melting upon being contacted by the molten debris. The conditions of finite wall thickness, continuous cooling at the wall outer surface, radiative cooling of the debris, temperature-dependent thermophysical properties, and internal heat generation in the debris are considered in the analysis. The governing equations are solved numerically using a one-dimensional, finite element code.

14002 **(NUREG/CR—1154(Vol.1)(No.2)) BWR Blowdown/Emergency Core Cooling fourteenth quarterly progress report, April 1-June 30, 1979. Volume 1, number 2.** Galyardt, D.L. (General Electric Co., San Jose, CA (USA)). May 1980. 29p. NTIS, PC A03/MF A01.

Blowdown/Emergency Core Cooling work completed in the second quarter of 1979 (April 1, 1979 through June 30, 1979) is summarized. During the second quarter a test plan was developed for the balance of the BD/ECC1A test phase and hardware and instrumentation changes were made to the Two-Loop Test Apparatus. Verified data was released for an average power/no Emergency Core Cooling test (Test 6406, Run 3) which was conducted as a repeat of the reference test without ECC. Data analysis continued during the second quarter and the key results of these analyses are discussed.

14003 **(NUREG/CR—1161) Recommended revisions to Nuclear Regulatory Commission seismic design criteria. Technical report.** Coats, D.W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). May 1980. 224p. NTIS, PC A10/MF A01.

This report recommends changes in the Nuclear Regulatory Commission's (NRC's) criteria now used in the seismic design of nuclear power plants. Areas covered include ground motion, soil-structure interaction, structures, and equipment and components. Members of the Engineering Mechanics Section of the Nuclear Test Engineering Division at Lawrence Livermore Laboratory (LLL) generally agreed upon the recommendations, which are based on (1) reports developed under the NRC's Task Action Plan A-40, (2) other available engineering literature, and (3) recommendations of nationally recognized experts retained by LLL specifically for this task.

14004 **(NUREG/CR—1162) Equipment and procedures used for preparing specimens from prompt burst energetics experiments.** Duliere, S.F. (Sandia National Labs., Albuquerque, NM (USA)). May 1980. 21p. NTIS, PC A02/MF A01.

Post-test examinations are required to aid in the evaluation of results from Prompt Burst Energetics Study experiments. In order to perform these examinations the test packages must be disassembled in a radiation shielded, non-oxidizing environment. This report describes the equipment and procedures used to accomplish the disassembly and to prepare specimens suitable for optical and scanning electron microscopic examinations.

14005 **(NUREG/CR—1321) Systems interaction methodology applications program. Final report on Phase 1.** Boyd, G.J.; Cramond, W.R.; Hatch, S.W.; Hickman, J.W.; Kolaczkowski, A.M. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1980. 205p. NTIS, PC A10/MF A01.

This report describes a method of reviewing nuclear power plant systems for potential interactions that is independent of the procedures used by the NRC in its Standard Review Plan (NUREG 75-087). The method described is the fault tree method using the Set Equation Transformation System (SETS) computer code for evaluating the fault trees to identify the potentially interactive cut sets. The report also assesses the Standard Review Plan to show where the potential interactions revealed by this independent method may be specifically discussed in the area of review, review procedures or acceptance criteria of the Standard Review Plan. The analysis for systems interaction presented in this report was restricted to normal plant operating conditions and incidents of moderate frequency as defined by ANS-51/N18.2. The analysis includes potential interactions that may arise because of commonalities of equipment location or physical connections. The report is a contributing element to the resolution of the problem being addressed by Generic Task Action Plan No. A-17 'Systems Interaction in Nuclear Power Plants'.

14006 **(NUREG/CR—1338) Allocation of NRC inspection effort to risk-related activities in nuclear power plants.** Lynch, G.J.; Bradley, G.H. Jr.; Brisbin, N.L.; Murphy, D.J. Jr. (Sandia Labs., Albuquerque, NM (USA)). Apr 1980. 128p. NTIS, PC A07/MF A01.

The inspection modules in the NRC inspection program for the Preoperational Test, Startup Test, and Operation phases of nuclear power plants were examined to assess whether manhours invested in each inspection were commensurate with the potential of these inspections for detecting conditions which would contribute significantly to risk. No basis was found in this assessment for fundamental changes to the inspection program. However, to improve program effectiveness, some modifications to specific parts of the program appear to be warranted.

14007 **(NUREG/CR—1417) Index to Nuclear Safety: a technical progress review by chrology, permuted title, and author, Volume 11(1) through Volume 20(6).** Cottrell, W.B.; Passiakos, M. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract W-7405-ENG-26. 152p. NTIS, PC A08/MF A01.

This index to Nuclear Safety, a bimonthly technical progress review, covers articles published in Nuclear Safety, Volume II, No. 1 (January-February 1970), through Volume 20, No. 6 (November-December 1979). It is divided into three sections: a chronological list of articles (including abstracts) followed by a permuted-title (KWIC) index and an author index. Nuclear Safety, a bimonthly technical progress review prepared by the Nuclear Safety Information Center (NSIC), covers all safety aspects of nuclear power reactors and associated facilities. Over 600 technical articles published in Nuclear Safety in the last ten years are listed in this index.

14008 **(NUREG/CR—1421) De-entrainment phenomena on vertical tubes in droplet cross flow. Informal report.** Dallman, J.C.; Kirchner, W.L. (Los Alamos Scientific Lab., NM (USA)). Apr 1980. Contract W-7405-ENG-36. 73p. NTIS, PC A04/MF A01.

In this study, flow conditions in the upper plenum of a PWR during the reflood stage of a loss-of-coolant accident (LOCA) are simulated using water sprays and a draft-induced wind tunnel. The de-entrainment efficiencies of isolated structures are presented for a variety of air-water droplet cross flow conditions. Since droplet splashing and/or bouncing from the draining liquid film is not accounted for in classical inertial impaction theory, there is substantial disagreement between measurement and the theory. The de-entrainment efficiencies of isolated tubes are extrapolated to those of tubes in a multiple tube array, and a predictive relation is presented for the overall de-entrainment efficiency of multiple tube arrays.

14009 **(NUREG/CR—1426) Development of a mechanistic model for ECC penetration in a PWR downcomer. Topical report.** Segev, A.; Collier, R.P. (Battelle Columbus Labs., OH (USA)). Jun 1980. Contract NRC-04-76-293-04. 88p. NTIS, PC A05/MF A01.

A one-dimensional mechanistic model has been developed to describe the flow behavior of a liquid film draining down a heated wall, in the presence of countercurrent vapor flow. The effects of nonequilibrium void generation at the walls and condensation of countercurrent vapor on the penetrating liquid film interface, as well as on the bypassed liquid, have been considered. A correlation, based on Kutateladze parameter, was developed from air-water experiments in 1/15- and 2/15-scale models with standard and distorted geometries. Theoretical predictions were compared with over 600 test results, obtained in 1/15- and 2/15-scale models of a PWR downcomer, and with test L1-4 conducted in the LOFT facility. The comparisons exhibit fairly good agreement. When applied to a full scale PWR, the analysis predicts that ECC penetration would occur at a time shorter than the recommended licensing time delay.

14010 **(NUREG/CR—1429) Seismic review table. Final report, October 1979-April 1980.** Subudhi, M.; Reich, M.; Koplik, B.; Lane, J. (Brookhaven National Lab., Upton, NY (USA)). May 1980. 300p. NTIS, PC A13/MF A01.

The Seismic Review Table is a summary of Engineering Design parameters that were employed in the seismic analysis and design of nuclear power plants. The table covers 71 reactors licensed to operate by the U.S.N.R.C. The information contained is listed plant by plant and consists of OBE and SSE 'g' level and Modified Mercalli Intensity; Earthquake Time History used to develop the ground response spectra or as input in the dynamic analysis; Number of Earthquake Components used and Method of Combining Them; Method of Modal Combination; Type of Ground Design Spectra; Method of Generation of Floor Response Spectra; Type of Foundation and Depth; Type, Thickness, Shear Wave Velocity and Shear Modulus Profile of the Surrounding Subgrade Soil and Bedrock; Ground Water Table Depth; nearby Dams; Modelling Method used for soil-structure interaction; Material Damping of Soil; Limitation on Modal Damping - Damping Values; and Loading Combinations, and Acceptance Criteria for Category I Structures, Mechanical Equipment, Piping, and Electrical systems. The goal of the Seismic Review Table is to provide a reference of the available information relevant to the seismic design of currently licensed nuclear power plants.

14011 **(NUREG/CR—1456) Experiment data report for semiscale MOD-3 small break test S-07-10 (baseline test series).** Sackett, K.E. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1980. Contract DOE-AC07-76IDO1570. 265p. NTIS, PC A12/MF A01.

Recorded test data are presented for Test S-07-10 of the Semiscale Mod-3 baseline test series. This is one of several Semiscale tests conducted to investigate the thermal-hydraulic phenomena resulting from a loss-of-coolant accident (LOCA) in a pressurized water reactor (PWR) system and to provide experimental data that can be used to assess the analytical capability of computer codes used in LOCA analysis. Test S-07-10 provided a data base for a Nuclear Regulatory Commission standard problem. The primary objective of Test S-07-10 was to experimentally characterize the thermal-hydraulic behavior of a system during a small break LOCA. Of special interest were the core uncovering characteristics and core thermal response which resulted from the slow depressurization. The purpose of this report is to make available the uninterpreted data from Test S-07-10 for future data analysis.

14012 **(NUREG/CR—1459) Experiment data report for Semiscale Mod-3 small break test series (tests S-Sb-2 and S-Sb-2A).** Miyasaki, D.H. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1980. Contract DE-AC07-76IDO1570. 318p. NTIS, PC A14/MF A01.

Tests S-SB-2 and S-SB-2A were performed as part of the Semiscale Mod-3 portion of the Semiscale Program conducted by EGandG Idaho, Inc., for the United States Government. These tests were part of the Mod-3 Small Break Test Series performed to investigate the thermal-hydraulic phenomena resulting from a small break loss-of-coolant accident (LOCA) in a pressurized water reactor (PWR) system, and to provide experimental data for assessing the analytical capability of computer codes used in LOCA analysis. The primary objective of Test S-SB-2 is to provide data for a small break LOCA in which the break flow rate is greater than the high pressure safety injection rate. The primary objective of Test S-SB-2A is to determine the sensitivity of the Mod-3 system behavior when the core power is augmented to offset system heat losses, and to assess the analytical capability of the computer codes to model the effects of the atypical heat losses in the Semiscale Mod-3 system.

14013 **(NUREG/CR—1511) Containment main steam line break analysis for equipment qualification. Informal report.** Lamkin, D.E.; Koestel, A.; Gido, R.G.; Baranowsky, P.W. (Los Alamos Scientific Lab., NM (USA)). Jun 1980. 65p. NTIS, PC A04/MF A01.

This study investigated the heat transfer boundary conditions that safety related equipment located in the containment might experience during a main steam line break (MSLB). In particular, bulk containment energy and condensed mass removal to passive heat sinks were studied. The boundary conditions for equipment located within the steam jet emanating from a MSLB are explored. A prescription for obtaining jet flow field parameters is also presented. This includes an accounting for the jet high underexpansion, normal shock, and the constant pressure portion. Several equipment qualification testing procedures are also recommended.

14014 **Simultaneous melting and freezing in the impingement region of a liquid jet.** Epstein, M.; Swedish, M.J.; Linehan, J.H.; Lambert, G.A.; Hauser, G.M.; Stachyra, L.J. (Argonne Natl Lab, Ill). *AIChE (American Institute of Chemical Engineers) Journal ;* **26**: No. 5, 743-751(Sep 1980).

An experimental investigation of an impinging water jet freezing on a melting solid surface has been carried out. Attention was focused on the stagnation region of an axisymmetric jet. In the experiment, a water jet was directed upward against the lower end of a meltable rod, having a diameter about twice that of the jet orifice. Solid octane (m.p.-56.5/degree/C) and solid mercury (m.p.-38.9/degree/C) served as the meltable materials. A laminar-axisymmetric flow model was developed to describe melting heat transfer in the presence of jet solidification within the impingement region. Measurements of the melting rate and conditions for the onset of jet solidification are found to agree quite well with the values predicted with this model. This work is pertinent to nuclear reactor fuel elements. 20 refs.

14015 **Seismic transient analysis of a containment vessel with penetrations.** Dahlke, H.J.; Weiner, E.O. (Westinghouse Hanford Co, Richland, Wash). *American Society of Mechanical Engineers, [Paper] ;* No. 80-C2/PVP-81, 1-8(1980).

A linear transient analysis of the FFTF containment vessel was conducted with STAGS to justify the load levels used for the seismic qualification testing of the heating and ventilation valve operators. The modeling consists of a thin axisymmetric shell for the containment vessel with four penetrations characterized by linear and rotational inertias as well as attachment characteristics to the shell. Motions considered are horizontal, rocking and vertical input to the base, and the solution is carried out by direct integration. 3 refs.

14016 **Non-linear thermal interaction between a heat-generating particulate bed and a solid.** Cheung, F.B.; Stein, R.P.; Epstein, M.; Gabor, J.D.; Bingle, J.D. (Argonne Natl Lab, Ill). *American Society of Mechanical Engineers, [Paper] ;* No. 80-HT-1, 1-8(1980).

The process of combined conduction and radiation in a large, heat-generating, dry particulate bed in sudden contact with a semi-infinite solid is studied analytically by a successive approximation method and numerically by a finite difference method. The transient behavior of the system, in particular the behavior of the temperature at the particulate bed-solid interface, is obtained as a function of two dimensionless controlling parameters. Also obtained are the conditions leading to incipient melting of the system. 3 refs.

14017 **Post-LOCA coolant piping dose rates: a plant shielding survey tool.** Warkentin, J.K.; Rubin, R.M. (Radiation Research Associates, Inc., Ft. Worth, TX). *Transactions of the American Nuclear Society ;* **34**: 658-659(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14018 **Determination of incipient boiling propagation from tests in a simulated LMFBR assembly.** Klein, G.A.; Haga, K. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 882-884(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

14019 **TRAC-PD2 analysis of the Bennett tube experiments.** Mandell, D.A.; Fujita, R.K.; Sicilian, M. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 894-896(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

14020 **Thermal-hydraulic calculation during blowdown using a simple 1-D code.** Leung, J.C.M.; Gallivan, K.A. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 896-898(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

14021 **Applicability of the atmospheric release advisory capability (ARAC) to nuclear power plant emergency preparedness.** Dickerson, M.H. (California Univ., Livermore). *Transactions of the American Nuclear Society ;* **34**: 726-727(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14022 **Behavior of homogeneous and heterogeneous LMFBRs under protected overpower transients.** Su, S.F.; Orechwa, Y. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 781-782(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14023 **Iodine releases, stream explosions, and molten fuel/concrete interactions.** Stratton, W.R. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 82(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14024 **Post-test analysis of the HEDL/TREAT HOP 1-6A experiment.** Thielges, J.R.; Sharp, L.D. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 209(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14025 **W-1 Sodium Loop Safety Facility experiment centerline fuel thermocouple performance.** Meyers, S.C.; Henderson, J.M. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 251(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14026 **In-pile MFCI test of carbide fuel, TREAT test AX1.** Doerner, R.C.; Bauer, T.H.; Wright, A.E. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 550-551(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14027 **Determination of UO_2 electrical conductivity change when heated through melt.** Wright, A.L.; Kress, T.S.; Smith, A.M.; Rochelle, J.M. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 551-552(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14028 **Response of high-burnup fuel to simulated thermal transients.** Fenske, G.R.; Bandyopadhyay, G. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 552-553(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14029 **Solidification in two-phase flow.** Petrie, D.J. (Argonne National Lab., IL); Epstein, M.; Linehan, J.H.; Lambert, G.A.; Stachyra, L.J. *Transactions of the American Nuclear Society ;* **34**: 554-556(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14030 **Calculation of the TMI-2 source-range monitor reading for several core water levels.** Childs, R.L. (Union Carbide Corp., Oak Ridge, TN); Selby, D.L.; Robinson, J.C.; Canada, R.G.; Monday, R.L. *Transactions of the American Nuclear Society ;* **34**: 558-559(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14031 **Neutronic sensitivity analysis of the SRM response for the TMI-2 accident.** Pickard, P.S. (Sandia Labs., Albuquerque, NM); Philbin, J.S.; Nelson, W.E.; Straker, E. *Transactions of the American Nuclear Society ;* **34**: 559-560(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14032 **Thermal-hydraulic analysis of the first 16 hours of the TMI-2 accident.** Cole, R.K. Jr. (Sandia Labs., Albuquerque, NM); Baskes, M.I.; Rumble, E.T. *Transactions of the American Nuclear Society ;* **34**: 562-563(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14033 **Plausible conditions of the TMI-2 core.** Powers, D.A. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 563-565(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14034 **OTSG modeling for the analysis of the TMI incident.** Hsu, C.J.; Shier, W.G.; Levine, M.M. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 573-574(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14035 **Analysis of CHF in loss-of-coolant experiments.** Leung, J.C.M. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 452-454(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14036 **Calculation of the CANON experiment using TRAC code.** Lekach, S.V. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 455-456(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14037 **Fission product release from high gap-inventory LWR fuel under LOCA conditions.** Lorenz, R.A.; Collins, J.L.; Osborne, M.F.; Malinauskas, A.P. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 462-463(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14038 **Independent assessment of TRAC-P1A with Moby-Dick nitrogen-water tests.** Saha, P. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 465-466(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14039 **Phenomenological modeling of small-scale steam explosion experiments.** Corradini, M.L. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 474-476(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14040 **Efficient nodalization for subcompartment force-moment analysis.** Gilbert, J.S.; Gido, R.G. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 488-490(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14041 **Effects of steel on a core meltdown in a sacrificial bed.** Pratt, W.T.; Gasser, R.D. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 492-493(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14042 **TRAC analysis of Three Mile Island accident.** Ireland, J.R. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 501-503(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14043 **Analysis of secondary systems transients in FFTF.** Perkins, K.R.; Bari, R.A. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 508-509(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14044 **Verification of the SSC-L code for FFTF transients.** Epel, L.G.; Guppy, J.G. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 509-510(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14045 **Vapor generation function for electrically heated volume-boiling systems.** Ginsberg, T. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 510-512(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14046 **Influence of steel vapor pressure on fuel motion in voided LMFBR channels.** Tentner, A.M.; Wider, H.U. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 512-513(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14047 **THUDD-1 code for simplified HCDA fluid/structure analysis.** Christie, A.M. (WARD, Madison, PA). *Transactions of the American Nuclear Society ;* **34**: 513-514(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14048 **LACOBRA/LAFM analysis of TREAT test H6.** Tomkins, J.L.; Mast, P.K. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 514-515(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14049 **Interpretation of TREAT heat balance experiments.** Vaurio, J.K.; Page, R.J.; Bauer, T. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 515-517(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14050 **Experimental validation of method for predicting fast-neutron hodoscope performance.** May, R.S. (Science Applications, Inc., Oak Brook, IL); Rhodes, E.; Hanan, N.A.; Fink, C.L.; DeVolpi, A. *Transactions of the American Nuclear Society ;* **34**: 517-518(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14051 **Analysis of fuel motion in recent TREAT experiments with LMFBR fuel.** Simms, R. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 518-519(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14052 **Generalized sensitivity theory applied to the MELT-IIIA fast reactor safety code.** Maudlin, P.J.; Parks, C.V. (Union Carbide Corp., Oak Ridge, TN). *Transactions of the American Nuclear Society ;* **34**: 520-521(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14053 **Hydraulic influences of TOP-generated blockages in an LMFBR subassembly.** Spencer, B.W. (Argonne National Lab., IL); Volpenhein, E.C.; Jones, B.G.; Hassan, Y.A. *Transactions of the American Nuclear Society ;* **34**: 521-523(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14054 **Modeling the coolability of TOP-generated porous heat generating blockages in LMFBR subassemblies.** Jones, B.G. (Univ. of Illinois, Urbana); Nithianandan, C.K.; Volpenhein, E.C.; Spencer, B.W. *Transactions of the American Nuclear Society ;* **34**: 523-524(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14055 **Effects of fuel-sodium film interaction and delayed fission gas release on extended fuel motion in a high-power LMFBR subassembly.** Henninger, R.J. (Los Alamos Scientific Lab., NM); Alcouffe, R.E.; Ganapol, B.D.; Clark, B.A. *Transactions of the American Nuclear Society ;* **34**: 524-525(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14056 **Failure analysis of carbide fuels under transient overpower (TOP) conditions.** Nguyen, D.H. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 525-526(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14057 **Neutron streaming effects during a GCFR HCDA-mitigation possibilities.** Wei, T.Y.C.; Sevy, R.H. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 528-529(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14058 **Energetics following loss of cooling in a shutdown GCFR.** Morris, E.E.; Sevy, R.H. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 529-530(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14059 **Energy absorption potential of PCRV in primary LMFBR containment.** Seidensticker, R.W.; Marchertas, A.H. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 530-531(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14060 **Hydrodynamic aspects of stratification and mixture within boiling immiscible mixtures.** Epstein, M. (Argonne National Lab., IL); Petrie, D.J.; Linehan, J.H.; Lambert, G.A.; Cho, D.H. *Transactions of the American Nuclear Society ;* **34**: 532-533(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14061 **Effect of thermal radiation scattering on heat transfer coefficient pertaining to multicomponent flows.** Chawla, T.C. (Argonne National Lab., IL); Chan, S.H. *Transactions of the American Nuclear Society ;* **34**: 533-534(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14062 **Debris bed experiment No. 4: a preliminary look.** Gronager, J. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 534-535(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14063 **Dryout in inductively heated bed with and without forced flow.** Squarer, D. (Westinghouse R and D Center, Pittsburgh, PA); Peoples, J.A. *Transactions of the American Nuclear Society ;* **34**: 535-537(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14064 **Modeling decay-heat-induced decomposition of a concrete slab.** Tobias, M.L. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 538-539(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14065 **NACOM code for analysis of postulated sodium spray fires in LMFBRs.** Tsai, S.S. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 539-540(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14066 **TREAT upgrade program objectives.** Dickerman, C.E.; Mueller, C.J.; Rose, D. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 541-542(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14067 **Experimental and theoretical bases for safety assessments of SAREF experiments.** Mueller, C. (Argonne National Lab., IL); Dickerman, C.E.; Rose, D.; Nicholson, R.B. *Transactions of the American Nuclear Society ;* **34**: 542-543(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14068 **HEDL W-1 SLSF experiment LOPI transient and boiling test results.** Henderson, J.M.; Rothrock, R.B.; Wood, S.A. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 544-545(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14069 **Results from the J1 low ramp rate TREAT experiment.** Page, R.J.; Rothman, A.B.; Marsh, G.E.; Schmidt, K.J.; Hopper, F.L.; August, C.; Johanson, E.; Larsen, G.; Froehle, P.H. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 545-546(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14070 **High-temperature magnesium oxide interactions with UO_2.** Varela, D.W. (Sandia Labs., Albuquerque, NM). *Transactions of the American Nuclear Society ;* **34**: 546-548(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14071 **Microwave heating simulations of fission energy generation in volume-boiling pool systems. Part II.** Makowitz, H.; Ginsberg, T. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 548-550(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14072 **Analytical chemistry response and Three Mile Island.** Shults, W.D.; Carter, J.A.; Emery, J.F.; Laing, W.R. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 152(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

25 ENERGY STORAGE

14073 **(CONF-801128—) Proceedings of mechanical, magnetic, and underground energy storage: 1980 annual contractors' review.** (MCC Associates, Silver Spring, MD (USA); Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 469p. NTIS, PC A20/MF A01.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Fifty-eight papers were presented at the meeting. A separate abstract was prepared for each of 54 papers. Four papers were previously processed for inclusion in the Energy Data Base. (LCL)

2501 Magnetic

14074 (CONF-801128—, pp 237-242) **Magnetic energy storage program overview.** Hoenig, M.O. (Massachusetts Inst. of Tech., Cambridge, MA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Due to large variations in demand, electrical utilities must produce a large fraction of their peak power output using premium fuels such as oil and gas. The use of diurnal energy storage would reduce power generating fuel costs, as well as reduce our reliance on imported oil, a national goal. Superconducting Magnetic Energy Storage (SMES) does not require the conversion of electrical to and from non-electrical forms. It is potentially more than 90% efficient. On the other hand, it represents the most advanced and capital intensive technology of any of the storage alternates. DOE has been supporting SMES, as well as alternate methods of energy storage for a number of years. Currently a small (8 KWH) SMES system is being built by Los Alamos Scientific Laboratory (LASL). It will be installed and operated at the Bonneville Power Administration (BPA) within a few years. Ultimately, a demonstration plant (0.5 to 50 MWH) will have to be built in order to qualify SMES for a full scale (1000 to 10,000 MWH) operation. A decision whether or not to build a demonstration plant will have to be made as early as 1983 by DOE. Innovative programs utilizing technological breakthroughs are needed in order to qualify SMES for demonstration plant funding.

14075 (CONF-801128—, pp 264-269) **30 MJ superconducting coil design and fabrication.** Purcell, J.R. (General Atomic Co., San Diego, CA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Bonneville 30 MJ superconducting stabilizing coil is being constructed by General Atomic under contract to LASL. Upon completion of the design, General Atomic began the procurement of materials and is now ready to start coil winding.

14076 (CONF-801128—, pp 271-270) **Diurnal superconductive energy storage system design.** Eyssa, Y.M.; Boom, R.W. (Univ. of Wisconsin, Madison). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The FY-80 study of superconductive energy storage for electric utility systems is reported. Conceptual designs have all been for one layer solenoids of aluminum-NbTi composite conductors cooled to 1.8 K in superfluid helium. The solenoids are mounted underground in bedrock in one or more tunnels. The two preferred designs in 1980 are: a 15 tunnel solenoid arranged in a circular pattern and a large radius single tunnel solenoid. The electrical energy storage efficiency in all cases is 95 to 96%.

14077 (CONF-801128—, pp 280-286) **Conductor and structural component studies for diurnal energy storage.** Van Sciver, S.W.; Han, K.S.; Hartwig, K.T.; McIntosh, G.F.; Young, W.C. (Univ. of Wisconsin, Madison). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A summary of recent progress in the development of structural and conductor components for the Wisconsin diurnal energy storage project is presented. Progress during the past year in structural design concepts and laboratory component development is discussed. Structural design concepts are presented which have been developed for the new low aspect ratio design for the energy storage coil. The major change in this area is cold structural support of axial forces with transmission of only radial forces to bedrock. The three areas in which laboratory studies have been carried out are: insulating structural material testing; cryogenic heat transfer studies and; subcomponent testing of the composite conductor. The specific problems investigated within the past year are; fracture and strain release of bonded glass fiber reinforced polyester, heat transfer from cylindrical geometries in superfluid helium II and shear strength, and thermal and electrical conductivity of joints in Al-Al and Al-Cu composite specimens. Some discussion of future directions for this effort is included.

14078 (CONF-801128—, pp 288-295) **Conductor design and development for superconducting magnetic energy storage magnets.** Larbalestier, D.C.; Hartwig, K.T.; West, A.W.; Moffat, D.L. (Univ. of Wisconsin, Madison). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The conductor of a superconducting magnetic energy storage (SMES) magnet designed for diurnal storage differs from conductors designed for other large superconducting magnets in a number of important respects. Since the purpose of a SMES magnet is to store electrical energy generated cheaply from base load capacity and then to supply it to the network at a later time when expensive peaking power would otherwise be used, the economic constraints are clear. Thus, the design of the SMES unit requires parallel attention to both the technical and economic feasibility of the solutions proposed. Such an analysis has led us to the choice of Nb-Ti of optimized and improved critical current density (J/sub c/) aluminum alloy as the structural material. The details of the arguments have been given previously; briefly they are that copper can never be affordable as a stabilizer since the weight required is too great and that Nb-Ti has increased so rapidly in price that a proper optimization for the desired field and temperature range is justified for a device where it forms about 15% of the total capital cost.

14079 **(LA-UR—81-622) Vacuum interrupters and thyratrons as opening switches.** Honig, E.M. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 14p. (CONF-810118—3). NTIS, PC A02/MF A01.

From Army research office workshop on repetitive opening switches; Durango, CA, USA (29 Jan 1981).

The clear advantages of inductive storage for large scale energy storage applications are creating an increasing interest in the research and development of the opening switches required. Opening switches for single-shot inductive transfers have received considerable attention and are fairly well advanced. The problem addressed by this workshop of high power opening switches for high repetition rate applications is much more severe, however, and may well require a major research and development effort. Two candidates for such an opening switch, the triggered vacuum interrupter and the magnetically quenched thyratron, are discussed. By electrically retriggering the discharge in the vacuum interrupter between pulses, the dependence on mechanical motion is eliminated. This should enable repetition rate operation at 10 to 15 kHz while still maintaining the vacuum interrupter's proven interrupting performance of tens of kiloamps at tens of kilovolts. The magnetically quenched thyratron, on the other hand, uses a cross magnetic field

to raise the switch impedance by decreasing the electron mobility and driving the discharge into an arc chute wall where it is quenched. Successful interruptions of 1 kA at 15 kV and 100 A at 50 kV after conduction for 10 μs have been demonstrated by previous researchers. Work at Los Alamos is directed toward understanding the basic mechanisms involved and increasing the switch ratings, particularly the conduction time.

2502 Compressed Gas

14080 (CONF-801128—, pp 125-130) **Compressed air energy storage technology program overview.** Loscutoff, W.V.; Kannberg, L.D. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Energy storage is a key element in the electric utility industry strategy for shifting energy consumption from oil to coal, nuclear and renewable energy sources. The DOE Compressed Air Energy Storage (CAES) Technology Program is directed at developing a new technology design to reduce the consumption of oil in the generation of electric power. The program has two major elements: Reservoir Stability Studies and Second-Generation Concepts Studies. The Reservoir Stability Studies are aimed at developing stability criteria for long-term operation of large underground reservoirs used for compressed air storage. The Second-Generation Concepts Studies are aimed at developing new concepts that will require little or no petroleum fuels for operation. In this overview, the program efforts during FY-1980 are outlined, the major accomplishments are identified, and future activities that are required to meet the objectives of the program are proposed.

14081 (CONF-801128—, pp 131-136) **PNL second-generation concepts studies.** Drost, M.K.; Reilly, R.W.; Young, J,K.; Zaloudek, F.R. (Pacific Northwest Labs., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Levelized power costs were estimated for three CAES concepts that do not require petroleum-derived fuels for operation. These concepts include: adiabatic CAES (ACAES) with aquifer air and heat storage; direct coupled steam (DCS)/CAES; and solar/CAES utilizing a high temperature central receiver. The results indicated that both the ACAES/aquifer and DCS/CAES concepts may be economically competitive with the ACAES/hard rock concept presently being studied by Acres American, Inc. (AAI). They both show substantial economic advantages over a present technology cycling coal-fired steam plant. The solar/CAES plant was found to have significantly lower power costs than a large central receiver, Rankine cycle solar power station. It also shows surprising competitiveness with the other advanced concepts CAES systems considered in this paper.

14082 (CONF-801128—, pp 148-176) **Adiabatic compressed air energy storage in hard rock.** Driggs, C.L. (Acres American Inc., Columbia, MD). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The findings of a conceptual design study performed during 1980 which examined pure adiabatic CAES cycles operating in the temperature range of 700 to 900°F are examined. The project involved an investigation of the technical and economic feasibility of using commercially available technology to construct a plant based on the PEPCO study site and plant design requirements. The plant configuration developed in this conceptual design study does not appear to include any design problems which would prohibit plant construction. A number of design areas require more detailed investigation before detailed design could progress. The levelized energy (production) cost evaluation has shown that despite somewhat poorer system efficiency, adiabatic CAES is very likely more economic than oil-fired CAES even at present fuel prices. Adiabatic CAES cannot, however, compete with substantially larger underground pumped hydroelectric (UPH) installations on a levelized cost basis. Alternatively, the adiabatic CAES design provides a potential energy storage plant optics for the size range of 200 to perhaps 100 mW for which the UPH design is likely unsuited because of high cost and long overall construction period. (LCL)

14083 (CONF-801128—, pp 178-183) **Analytical modeling of the Champagne Effect in hydraulically compensated CAES reservoirs.** Rowe, D.S.; McMonagle, C.A. (Rowe and Associates, Bellevue, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

An analytical model has been developed and a variety of preliminary, conservatively oriented calculations have been performed which indicate the Champagne Effect is unlikely to cause blow-out for a properly designed CAES system. A one-dimensional analytical model is used to represent the entire system consisting of the air-pipe, storage cavern, compensation pipe and surface reservoir. Thermo-hydraulic aspects of air, water and dissolved air are modeled using the two-fluid approach. Variations in design and constitutive relationships have been studied to show that a reduction of dissolved air, an increase of friction and a deep compensation reservoir mitigate the Champagne Effect. The most conservative results are obtained when homogeneous flow and equilibrium deaeration of the water are assumed. Best estimate calculations of CAES opeation could be done through a refinement of constitutive relations and validation with experimental data.

14084 (CONF-801128—, pp 185-191) **Reservoir stability studies.** Doherty, T.J. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Reservoir Stability Studies project is the geotechnical component of the Compressed Air Energy Storage Technology Program at the Pacific Northwest Laboratory. Its purpose is to establish stability criteria for underground air storage reservoirs for CAES application in salt, hard rock and porous media geologies through applied research studies. The overview and structure of that project and 1980 progress with respect to program goals are discussed. Included is summary reporting on fluid thermal and thermomechanical modeling of porous media reservoirs.

14085 (CONF-801128—, pp 192-198) **Numerical modelling of behavior of caverns in salt for compressed air energy storage with elevated temperatures.** Serata, S.; McNamara, J.F. (Serata Geomechanics, Inc., Berkeley, CA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A program is described which employed the use of finite element analysis to investigate the sensitivity of long-term salt cavern behavior to variation in critical cavern design parameters. The program was divided into four phases: Phase I -- Model modification and Testing; Phase II -- PNL Selected Test Case; Phase III -- Single Cavern Axisymmetric Analysis; and Phase IV -- LSU Borehole Analysis. It was concluded that within the scope of this study, as long as the extreme values of the critical parameters are not approached, salt caverns for CAES application can be considered stable for at least thirty years. Further investigation should be made in the areas of in situ stress determination, laboratory testing of salt properties, and comprehensive accumulation of existing field data to better correlate the REM finite element program to empirical data.

14086 (CONF-801128—, pp 199-205) **Laboratory tests of rock salt.** Thoms, R.L. (Louisiana State Univ., Baton Rouge). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Tests of rock salt are described for applications relative to long-term compressed air energy storage (CAES) in salt reservoirs. Effects of cyclic loads on strength (and stability) and permeability of rock salt are investigated through an integrated study including laboratory and in situ tests and limited complementary numerical modeling.

14087 (CONF-801128—, pp 206-212) **Numerical studies of CAES caverns in hard rock.** Brandshaug, T.; Fossum, A.F. (RE/SPEC Inc., Rapid City, SD). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A program to develop and use numerical models to evaluate the behavior of compensated CAES caverns in hard rock and to

establish a methodology for the development of stability criteria is summarized. It is concluded that there is adequate information available to enable a designer to design an underground opening with the size, shape, and depth required of a CAES cavern with regard to its excavation and construction, based on a combination of numerical modeling and precedent considerations. It is recommended that numerical methods be used in combination with in situ tests to permit the development of a design methodology for the operation of a CAES cavern.

14088 (CONF-801128—, pp 213-219) **Laboratory studies of hard rock for CAES.** Fossum, A.F. (RE/SPEC Inc., Rapid City, SD). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A program is summarized that investigated the properties of hard rock specimens from formations suitable for CAES that are subject to the conditions envisioned for a CAES cavern by means of laboratory scale testing. It was concluded that although the compressive and tensile strengths are adversely influenced by a Compressed Air Energy Storage Cavern environment, the reduced failure strength of hard rocks is sufficiently high to indicate that a CAES plant could be operated satisfactorily.

14089 (CONF-801128—, pp 220-226) **Investigating air/water/rock interactions in a CAES porous rock reservoir.** Stottlemyre, J.A. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

FY-1980 laboratory tests on sandstones and well casing materials subjected to simulated Compressed Air Energy Storage (CAES) conditions are summarized. The objectives of this experimental program are: to generate and interpret data that can be used to select reservoirs and develop operating criteria, and assess environmental issues; and to develop equipment and procedures for site-specific field project support. Specific subtasks described herein cover well casing corrosion tests; sandstone permeability and mechanical stability tests with elevated-temperature dry air; similar tests with groundwater; and the development of strategy for future experiments in the porous-media flow facility currently undergoing acceptance testing.

14090 (CONF-801128—, pp 227-233) **Field studies of porous rock reservoirs.** Rudd, N. (Dames and Moore, Mt. Vernon, IL); Allen, R.D. 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A small-scale field experiment is planned to test compressed air energy storage (CAES) in porous rock reservoirs (aquifers). The proposed site is located west of the town of Pittsfield in Pike County, Illinois. In this project, warm compressed air will be injected into a shallow aquifer and air migration, water displacement, and temperature change will be monitored within a radial array of instrumented, small-diameter boreholes. Changes in chemical and physical properties of reservoir and caprock will be evaluated by analysis of cores obtained before and after injection and air cycling. The project is divided into three phases: I. Development of the field test plan and preliminary site selection; II. Exploration and confirmation of specific site and site acquisition; and III. Site development, surface plant installation, field testing, and laboratory examination. Phase I is complete, and Phase II is expected to be completed in 1980.

14091 **(PNL-SA—7683) Fluid-bed-augmented CAES systems.** Giramonti, A.J. (United Technologies Research Center, East Hartford, CT (USA)). 1979. Contract AC06-76RL01830. 15p. (CONF-790515—7). NTIS, PC A02/MF A01.

From International assembly on energy storage; Dubrovnik, Yugoslavia (27 May 1979).

Compressed Air Energy Storage (CAES) systems are potentially attractive for future electric utility load leveling applications. A potential long-term weakness of the conventional CAES concept is its reliance on clean petroleum fuels during the power generation period. This consumption of petroleum could be completely eliminated by the use of coal-fired fluid bed combustors in second generation CAES plants. A large number of CAES power system configurations are possible using atmospheric fluid bed combustion (AFBC) and pressurized fluid bed combustion (PFBC). The fuel consumption rates for these systems are generally comparable to those for oil-fired CAES systems. The future prognosis for using PFBC in CAES systems looks good. Recent corrosion and erosion experiments in fluid bed systems suggest that gas turbines with acceptable lifetimes in fluid bed systems suggest that gas turbines with acceptable lifetimes are a distinct possibility. The commercial status of these systems depends on the outcome of extensive corrosion/erosion testing in static and rotating test rigs. CAES systems using AFBC may be an attractive alternative to using PFBC, although the materials problem would then be transferred from the turbine to the high temperature heat exchanger surface. A reasonable expectation for the date of commercialization of fluid bed augmented CAES system ranges from 10 to 15 years.

2503 Pumped Hydro

REFER ALSO TO CITATION(S) 13577, 13580, 13806

2505 Flywheels

REFER ALSO TO CITATION(S) 14374, 14375

14092 (CONF-801128—, pp 299-306) **Overview of the mechanical energy storage technology (MEST) project.** Barlow, T.M. (Univ. of California, Livermore). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

An overview is presented of the Lawrence Livermore National Laboratory's Mechanical Energy Storage Technology Project, under which the field technical management of the DOE's flywheel technology program is exercised. Included is a summary of the project's objectives and approach, structure, and principal accomplishments in FY 1980. The general trend in future plans is briefly described.

14093 (CONF-801128—, pp 307-314) **Mechanical energy storage technology application to electric vehicles.** Cornell, E.P.; Turnbull, F.G. (General Electric Co., Schenectady, NY). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The development, fabrication, and testing or a regenerative flywheel energy storage system for a battery/flywheel electric vehicle for commuter application is reviewed. The system consists of a steel flywheel coupled to a high-speed inductor motor/alternator fed by a load-commutated inverter/rectifier which does not utilize a shaft position sensor for inverter control. Computer control is used to provide component as well as overall system control and data acquisition. This flywheel energy storage system was laboratory tested over the SAE J227a Schedules D, C, and B driving cycles, using a laboratory simulation of an electric vehicle drive. Results show that maximum benefit occurs on the Schedule D cycle for which the overall system was optimized. From these tests, recommendations for additional improvements to this propulsion system are made.

14094 (CONF-801128—, pp 340-345) **Photovoltaic energy system applications of flywheel technology.** Jarvinen, P.O. (Massachusetts Inst. of Tech., Cambridge, MA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Progress is reported on a project to develop a flywheel energy storage unit for use with photovoltaics in residential or load-center applications. The unit employs a high-efficiency, permanent-magnet motor-generator and uses either stand-along cycloconverter or utility-interactive inverter power converters to convert dc input to regulated ac output. It also tracks the maximum-power-operating point of the solar array. Magnetic bearings are used to support the rotating element. The project includes fabrication and test of a scale-model unit, measurement of round-trip storage efficiencies, demonstration of cycloconverter and utility-interactive inverter hardware and economic analyses of residential and intermediate

load-center flywheel systems for manufacturing cost and user worth.

14095 (CONF-801128—, pp 346-354) **Development and assessment of stationary flywheel storage technologies.** Eisenhaure, D.B. (Charles Stark Draper Lab., Cambridge, MA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The project for development and assessment of stationary flywheel storage technologies consists of the following elements: development of advanced hybrid ball/magnetic bearings and lubrication systems; experimental investigation of magnetic bearing concepts and systems; investigation of field-modulated machines for flywheel applications; development of a MOSFET based power conversion system for flywheel applications; systems analysis directed toward assessing the status and worth of stationary flywheel storage. Work in the assessment area is currently directed toward assessing the worth of flywheels with current technology and with today's energy costs. Experimental investigations have indicated a number of areas where the performance of flywheel systems can be enhanced through technology improvements.

14096 (CONF-801128—, pp 355-362) **Continued development of the band-type variable inertia flywheel.** Ullman, D.G. (Union Coll., Schenectady, NY); Corey, J. 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The design, equations-of-motion, and prototype testing of a band-type variable inertial type flywheel are discussed. The Band-Type Variable Inertial Flywheel (BVIF) is a single mechanism, which, unlike conventional flywheels does not require any intermediate transmission equipment. A BVIF has been built and operated which is capable of smoothly accelerating a directly-connected inertial load from rest to a final speed without significant clutch-slipping losses or any additional transmission devices. There are essentially three ways to attach loads to a BVIF. The first is an open-loop system with two degrees of freedom, referred to as the Type I. The second (Type II) is a single-degree-of-freedom unit with a fixed ratio between hub speed and casing speed. Third (Type III) has two degrees of freedom like Type I but includes power recirculation through a gear train like Type II. Of these, the Type III has been identified as the most promising configuration. The Type III BVIF is capable of accelerating inertial loads smoothly and with stability to a terminal speed. That final speed can be greater than the initial flywheel speed, and both inner and outer elements of the BVIF slow down. The Type III BVIF is ideally capable of yielding more than half of its stored energy to the load during such an operation. Prototype testing in the Type III mode has produced real-world evidence of Type IIIBVIF capacity. Further work remains to be done to fully characterize the nature of such systems. The next step in BVIF development is to integrate it into a system with a prime mover. The BVIF with its accelerating capability seems a good choice for hybridizing with a prime mover to add additional power during acceleration and absorbing power during braking.

14097 (CONF-801128—, pp 363-369) **Applications of cellulosic materials in flywheel rotors.** Hagen, D.L.; Erdman, A.G.; Gaff, S.A. (Univ. of Minnesota, MN). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Preliminary studies of cellulosic rotors indicate that plywood cores in compound rotors and rotors wound with high performance paper appear promising. Material properties that are critical in designing a plywood rotor core are reviewed. Tensile tests of the distribution of strengths for vacuum dried hexagonal birch plywood show an approximately 10% decrease in performance upon drying from ambient conditions. High resolution tensile stress-strain tests coupled with precise digitally integrated acoustic emission measurements are proposed to estimate long term strength. Preliminary results are described. Measurements of the tensile fatigue of plywood samples are discussed. The hygroscopic nature of cellulose requires that consideration be given to careful drying of the material, and to the moisture release and outgassing rates in a vacuum. Similar phenomena are expected for other composite rotor materials.

14098 (CONF-801128—, pp 370-378) **Alpha-ply laminated-disc flywheel rotor.** Nimmer, R.P. (General Electric Co., Schenectady, NY). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The composite flywheel concept being developed under this Lawrence Livermore Laboratory contract is made up of a laminated S2-glass/epoxy disc and a filament wound graphite/epoxy outer ring. The two components are assembled with an interference fit and an aluminum hub is elastomerically bonded to the central disc. With this approach both high energy density and high volume efficiency (in comparison to other composite rotors) should be attainable. During the past fiscal year, two hybrid disc/ring flywheels were built and tested at the Johns Hopkins Applied Physics Laboratory. These wheels reached approximately 54 Wh/kg and 57 Wh/kg (24.5 Wh/lb) and 26 Wh/lb) before ultimate failure. In addition, two larger prototype flywheels were designed and built. As a part of the design process, extensive information was gathered with respect to failure modes, material properties, residual stresses and dynamic characteristics. The improved design of these larger wheels should be reflected by energy densities in the vicinity of 60 to 66 Wh/kg (27 to 30 Wh/lb). At writing, the first prototype wheel is currently being tested at the Oak Ridge National Laboratory.

14099 (CONF-801128—, pp 380-384) **Evaluation of composite flywheel materials construction.** Sapowith, A.D. (Avco Systems Division, Wilmington, MA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A preliminary effort was made to characterize the tensile properties of Avco's bi-directional hoop and radial flywheel weave. Initial designs were woven in S glass, molded and tested to determine tensile strengths and moduli in both the hoop and radial directions. These data were used with Avco's WHEEL code to produce estimates of specific energy capability at burst. The energy estimate for these initial flywheel weaves was 28 W-hrs/lb. Follow-on work was proposed to improve projected performance and such efforts are underway.

14100 (CONF-801128—, pp 385-392) **Flywheel technology development at APL.** Rabenhorst, D.W. (Johns Hopkins Univ., Baltimore, MD). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Applied Physics Laboratory's flywheel technology efforts in three separate areas are summarized. The first area covers a rather extensive design study for an expansion of the Applied Physics Laboratory flywheel spin test facility to accommodate burst testing of flywheels up to 50 kW hours capacity. The second area covers the preliminary development of flywheels made from metallic glass ribbon. The third area concerns the spin testing of a variety of flywheels fabricated outside the laboratory, and provided by the Lawrence Livermore Laboratory. The conceptual design of the new flywheel spin test facility is complete, and the preparation of construction details, including cost and schedule items, is proceeding on schedule. The metallic glass flywheel spin testing to date has indicated that this configuration will be quite competitive in terms of energy per unit weight, energy per unit cost, and most especially in energy per unit volume. The outside flywheel spin testing program has included ten spin tests involving five different flywheel configurations. All were eventually spin tested to destruction, with complete video coverage.

14101 (CONF-801128—, pp 393-407) **Low-cost compression molded fiber reinforced flywheels.** Kay, J.F. (Owens-Corning Fiberglas, Granville, OH). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Compression molded structural sheet molding compound (SMC) has been used to fabricate energy storage flywheel rotors. This technique has the potential of low-cost, high-throughput production of rotors for the automobile industry. An isophthalic polyester resin and either E or S-2 Glass reinforcement were used for both constant and tapered molded rotors 21 inches in diameter. Materials characterizations have shown a tensile strength of 39 Ksi for

the S-2 Glass reinforced rotors, which would allow the flywheel rotor to store approximately 44 watt hours per kilogram.

14102 (CONF-801128—, pp 407-413) **Fabrication of high performance, filament-wound fiber composite rings.** Hannibal, A.J. (Lord Kinematics, Erie, PA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The purpose of this project was to fabricate circumferentially wound fiber composite rings for General Electric's laminated disk flywheel program. The project has been completed. In all, composite rings were fabricated on a computer controlled filament winding machine. Eleven of these rings were made of graphite/epoxy and the remainder were made of Kevlar 49/epoxy. The rings had either an 11.0 in. or 14.5 in. inside. They were 1.0 in. in axial thickness and range in annular thickness from 0.5 to 2.5 in. The fabrication method was basically a wet winding process using a circumferential wrap of a fiber tow under tension onto a mandrel. To assure satisfactory quality and appearance, several process issues were addressed, including fiber tie-off, accommodation of the mandrel taper and outside surface finish. One ring was wound directly onto a laminated composite disk. Although its appearance was good, the difference in thermal expansion and contraction between the ring and the laminated disk caused them to separate after the cure cycle. Several shortcomings in the composite rings were observed as a consequence of the winding process; namely, poor sidewall finish, the presence of residual stresses, nonuniform fiber fraction and void content in the radial direction, and relatively weak transverse strength. These problems are being worked on.

14103 (CONF-801128—, pp 414-418) **State-of-the-art review of flywheel burst containment.** Sapowith, A.D.; Witmer, E.A. (Avco Systems Division, Wilmington, MA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A preliminary state-of-the-art of composite flywheel burst containment was conducted. Starting from a base of burst containment for aircraft turbines, comparisons are made between Kevlar and steel as containment rings and the relative difficulty of containment of composite materials as against steel (turbines). Failure mode analysis of a disc-type flywheel indicates that low containment weights can be achieved by capturing the burst energy as rotational rather than translational. A design to do this is descibed. A Follow-on Program to further develop containment design is in progress.

14104 (CONF-801128—, pp 419-427) **Flywheel containment technology assessment.** Coppa, A.P.; Zweben, C.H. (General Electric Co., Philadelphia, PA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The particular aspects and results of a program to assess containment technology that is currently available for the development of efficient flywheel systems and to design and fabricate preliminary containment structures for use in current prototype energy storage flywheel tests is reported. The need to optimize and integrate the design of containment housings with the rotor design is emphasized. Fragmentation characteristics of composite rotors are discussed. Some preliminary design methods presently being developed for composite rotor containment are outlined.

14105 (CONF-801128—, pp 428-434) **Fiber composite materials technology development.** Chiao, T.T. (Univ. of California, Livermore). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The FY1980 technical accomplishments from the Lawrence Livermore National Laboratory (LLNL) for the Fiber Composite Materials Technology Development Task of the MEST Project are summarized. The task is divided into three areas: Engineering data base for flywheel design, new materials evaluation, and time-dependent behavior of Kevlar composite strands. An epoxy matrix has been formulated which can be used in composites for 120°C service with good processing and mechanical properties. Preliminary results on the time-dependent properties of the Kevlar 49/epoxy strands indicate: Fatigue loading, as compared to sustained loading, drastically reduces the lifetime of a Kevlar composite; the more the number of on-off load cycles, the less the lifetime; and dynamic fatigue of the Kevlar composite can not be predicted by current damage theories such as Miner's Rule.

14106 (CONF-801128—, pp 435-442) **Engineering properties determination for composite materials.** Hahn, H.T.; Chin, W.K. (Washington Univ., St. Louis, MO). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The purpose of this program was to determine the mechanical properties of a Kevlar 49/epoxy composite in a simulated flywheel service environment. The composite was filament-wound using an epoxy formulated at LLNL. The temperature and vacuum chosen were 75°C and $\sim 6 \times 10^{-3}$ torr, respectively. Specimens were preconditioned in the test environment for periods of 1 to 5 months before mechanical tests. The simulated service environment seems beneficial for static strength while it has negligible effect on fatigue strength. Two factors seem responsible for such behavior: moisture desorption and lack of oxidation in vacuum. Thus, the elevated temperature of 75°C is no deterrent to the application of the Kevlar 49/epoxy composite in flywheels.

14107 (CONF-801128—, pp 443-451) **Composite flywheel testing and evaluation at the Oak Ridge Flywheel Evaluation Laboratory.** Steele, R.S. Jr.; Babelay, E.F. Jr. (Union Carbide Corp., Oak Ridge, TN). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The results are summarized of spin tests conducted in the Oak Ridge Flywheel Evaluation Laboratory under a subcontract from Lawrence Livermore National Laboratory for the purpose of determining the ultimate energy density capabilities of the Garrett-AiResearch, William M. Brobeck and Associates, Hercules Aerospace, and Rockwell-Rocketdyne flywheel rotors. A short description of each test is presented as well as data used to determine each failure mode. The conclusion was reached that each of these flywheels was limited by generic problems involving the attachment of a heavy rim to a central shaft.

14108 **(SAND—79-7098) Residential energy storage flywheel with a wind turbine supply.** Place, T.W. (AiResearch Mfg. Co., Torrance, CA (USA)). Apr 1981. Contract AC04-76DP00789. 103p. NTIS, PC A06/MF A01.

The conceptual design was developed for a minimum cost flywheel energy storage system which is suitable for mechanical interfacing with a wind-turbine energy source. The system has 10 kWh storage capacity and will provide 5 kW peak power/output. Special emphasis was placed on assuring that the system design is adaptable for upward-scaling to 50 kWh storage capacity and 10 kW peak power output. In accordance with the Sandia contract requirements, the design is based on current technology and can be built using conventional manufacturing facilities and processes. The system will provide 76% round trip efficiency and 1%/h maximum rundown loss. For production rates of 100,000 units per year, the estimated selling prices for the system in the 10 kWh and 50 kWh storage sizes are $3581 ($358/kWh) and $9800 ($196/kWh), respectively. This report traces the evolution of the system design from the initial baseline concept to the final configuration and discusses the technical and economic considerations and decisions which shaped that evolution.

2506 Thermal

14109 (CONF-801128—, pp 5-8) **Seasonal thermal energy storage program.** Minor, J.E. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Pacific Northwest Laboratory (PNL) was assigned management of the Seasonal Thermal Energy Storage Program (STES) by the DOE Office of Advanced Conservation Technologies in April, 1979. STES Program plans have been formulated; work breakdown structures developed and modified as planning proceeded, and a matrix of external contracts have been placed. The research and demonstration work of the STES Program is being per-

formed by industry, universities, and PNL and other DOE laboratories. The STES Program incentives, objectives, and long-range implementation plan for achieving program goals are described.

14110 (CONF-801128—, pp 10-16) **Bethel, Alaska, aquifer thermal energy storage project.** Cherne, J. (TRW Energy Systems, Redondo Beach, CA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

TRW Energy Systems Group, under contract to Battelle Pacific Northwest Laboratories, is developing the conceptual design of a seasonal thermal energy storage system in Bethel, Alaska, using an aquifer for storage. The system consists of a diesel electric generating plant as the source of the thermal energy, an aquifer beneath the property of the utility, and an energy transport system to take the energy from the utility, store it in the aquifer, and provide it to the city for space heating and hot water of the local hospital, municipal buildings, schools and residences. Progress made this year in characterizing the aquifer and the development of a system design criteria for use in the conceptual design is described.

14111 (CONF-801128—, pp 27-33) **Conceptual design of aquifer thermal energy storage system demonstration: State University of New York, Stony Brook Campus, Long Island.** Stern, L.I. (Dames and Moore, Cranford, NJ). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Work to date on the Conceptual Design (Phase I) of an aquifer thermal energy storage system to store winter chilled water for summer air conditioning use is summarized. The two-phase Program is to demonstrate the technical, economic, environmental, and institutional feasibility of aquifer thermal energy storage systems. Phase II, which is dependent upon Phase I results, is the detailed design, construction, start-up, and test operation of the system before turning it over to the State University of New York (SUNY).

14112 (CONF-801128—, pp 35-37) **Legal and regulatory issues applicable to aquifer thermal energy storage.** Hendrickson, P.L. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Research conducted during FY 1980 at the Pacific Northwest Laboratory on the subject of legal and regulatory issues affecting the aquifer thermal energy storage (ATES) concept are summarized. The investigation considered issues in four subject categories: regulatory requirements prior to operation; potential liability from ATES operations and available means to mitigate possible liability; issues related to storage and recovery of the energy resource, and institutional and financial issues applicable to delivery of the stored energy resource.

14113 (CONF-801128—, pp 38-41) **Economic assessment of aquifer thermal energy storage.** Reilly, R.W.; Brown, D.R.; Huber, H.D. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The FY 1980 economic assessment program undertaken at PNL in support of the Seasonal Thermal Energy Storage (STES) Program are described. The effort was composed of four major activities: summary of the existing state of the Aquifer Thermal Energy Storage (ATES) technology, development of a techno-economic computer code for in-depth economic analysis of ATES systems, initial investigations into the cost of heat and chill storage, and development of a methodology for conceptual design and evaluation of ATES systems. The first three activities were performed in-house, and form the basis for continuing economic analysis of ATES at PNL. The results of these activities are discussed. The first activity is complete and the results are published in A Descriptive Analysis of Aquifer Thermal Energy Storage Systems, June 1980 (PNL-9238). The techno-economic computer code, AQUASTOR, is operational, and is presently undergoing refinement. It will be made available to the general public in March 1982, after completion of testing and documentation. Initial work on chill storage economics was presented in a paper at the 15th Intersociety Energy Conversion Engineering Conference in a paper entitled, The Economics of Aquifer Storage of Chilled Water for Air Conditioning. This paper will present initial findings on heat storage economics. The fourth activity has resulted in Guidelines for Conceptual Design and Evaluation of Aquifer Thermal Energy Storage Systems, a document now in the final stages of publication.

14114 (CONF-801128—, pp 42-46) **Development of guidelines for conceptual design and evaluation of aquifer thermal energy storage systems.** Meyer, C.F.; Hausz, W. (General Electric Co., Santa Barbara, CA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A 10-step methodology which has been developed for conceptual design of an ATES system and evaluation of its technical and economic feasibility is summarized and discussed.

14115 (CONF-801128—, pp 47-51) **Environmental assessment.** Wukelic, G.E.; Zuck, J.C. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Environmental Assessment task of the Seasonal Thermal Energy Storage (STES) Technical Support Program that has been established to ensure the environmental acceptability of promising STES concepts prior to their commercialization. The task emphasizes: developing environmental documentation required for NEPA compliance; guiding environmental activities for field testing and demonstration projects; and evaluating technical information generated from research and development activities for environmental implications. To date, the task has successfully initiated the necessary DOE and non-DOE coordination to clarify NEPA environmental documentation requirements in support of the STES Program's emphasis on aquifer thermal energy storage (ATES) research, development, and demonstration. This task, assisted by external contractors, has recently completed the draft programmatic Environmental Assessment for the ATES Subprogram (to be published in FY 81) and has guided the development of comprehensive environmental assessment and monitoring plans for the ATES Demonstration Projects. Future efforts will stress analyzing data provided through ATES research, development, and demonstration activities to refine estimates of environmental impacts and to identify necessary environmental control measure, and educating the general public and responsible regulatory agencies about the environmental concerns pertaining to the ATES technology.

14116 (CONF-801128—, pp 52-55) **Programmatic environmental assessment (documentation).** Lee, D.W. (Oak Ridge National Lab., TN). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The environmental documentation for the Aquifer Thermal Energy Storage subprogram is being prepared to comply with the regulations promulgated by the Council on Environmental Quality. The preliminary draft Environmental Assessment has been reviewed and revisions have been incorporated into a revised draft Environmental Assessment. Environmental consequences of the Aquifer Thermal Energy Storage subprogram are expected to be site-specific.

14117 (CONF-801128—, pp 56-61) **Environmental analysis/consulting: ATES demonstrations environmental assessment.** McCartney, H.E. (Resource Management and Assessment, Everett, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The environmental activities related to the Aquifer Thermal Energy Storage (ATES) demonstration projects are summarized. These activities are being performed by a combination of PNL, ORNL, and Resource Management and Assessment staff. Environmental activities for the ATES demonstration projects include: environmental input during the procurement process; and coordination with the demonstration contractors during the preparation of the environmental assessment and monitoring plans for Phase I and during the preparation of environmental impact reports for Phase II. Separate environmental assessment and monitoring plans for Phase I (conceptual design) activities have been developed and environmental impact reports are being prepared for Phase II activi-

ties (final design, construction and operation). The purpose of these documents is to identify and minimize potential environmental problems, to facilitate accumulation of needed environmental information, and to fulfill NEPA requirements. Site-specific environmental issues are identified; monitoring plans and mitigating strategies are presented to address these issues.

14118 (CONF-801128—, pp 62-63) **Field test facility.** Myers, D.A. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Field Test Facility (FTF) subtask of the Technical Support Program is designed to provide actual field tests to provide operational experience and guidance to the Aquifer Thermal Energy Storage (ATES) Demonstration Program. Efforts during FY 1980 have been directed toward the identification of suitable FTF sites and expansion of the test program at the Mobile, Alabama, FTF site.

14119 (CONF-801128—, pp 64-70) **Field studies of the aquifer thermal energy storage concept.** Parr, A.D.; Molz, F.J.; Melville, J.G. (Auburn Univ., AL). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

In March of 1978, experiments related to using confined aquifers for the temporary storage of heat were begun at a field test site in Mobile, Alabama. Two six-month injection-storage-recovery cycles were performed wherein approximately 55,000 m^3 (14.5 million gallons) of water were pumped from a shallow supply aquifer, heated to an average temperature of 55°C, and injected into a deeper confined aquifer with an ambient temperature of 20°C. After 2 months, the water was recovered from the confined aquifer. Clogging of the injection-production well during injection was an important negative result of the Mobile experiments. Using water from the storage aquifer as supply water for the boiler or other heating system would minimize clogging problems. Drilling the supply well and the injection-production well in the same formation leads to what is called the doublet configuration. If aquifer storage of thermal energy becomes feasible on a commercial scale, it seems likely that a system based on the doublet configuration will offer distinct advantages. Therefore, there is a real need to study this concept experimentally so that potential advantages and disadvantages can be identified clearly before major amounts of money are invested in the concept. In order to test a doublet supply-injection well configuration, a third round of experiments consisting of 3 injection-storage-recovery cycles are scheduled to begin in January, 1980, at the Mobile site. A schematic of the doublet system is shown in Figure 1. The injection and supply wells fully penetrate the confined aquifer and are separated by 244 m. High injection temperatures will be used during the last two cycles in order to investigate the effect of increased buoyancy on energy recovery. The design and planned procedures for the upcoming experiments and the results of a preliminary anisotropy pumping test which was performed recently are discussed.

14120 (CONF-801128—, pp 72-76) **Compendia of existing information task.** Prater, L.S. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Compendia of Existing Information Task is a technical support task of the Seasonal Thermal Energy Storage (STES)Program. The task goal is to collect, summarize and transmit STES-related information. The task consists of five subtasks: Library Establishment, Maintenance, and Development; Literature Reviews and Summary Papers; STES Newsletter Publication; Production and Maintenance of the Aquifer Thermal Energy Storage Reference Manual; and Development of the STES Data Base. Highlights of technical progress include the following: the STES Library has been established and now contains over 1500 articles with a wide range of key references on topics related to thermal energy storage; literature reviews and topical reports on subjects of importance to the STES Program are being prepared; a newsletter containing brief reports about STES projects around the world is being published quarterly; the Aquifer Thermal Energy Storage Reference Manual has been issued; and a computerized STES Data Base is being established.

14121 (CONF-801128—, pp 89-95) **Physicochemical properties analyses in support of the seasonal thermal energy storage program.** Stottlemyre, J.A. (Pacific Northwest Lab., Richland, WA); Cooley, C.H.; Banik, G.J. 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

FY 1980 activities concerning the physical and chemical stability of aquifers subjected to Seasonal Thermal Energy Storage (STES) operating conditions are summarized. Subtasks include the development of laboratory and field equipment, an assessment of geochemical modeling, and laboratory-scale investigations of the permeability/creep compaction stability of quartz sands. Terra Tek Inc. is in charge of developing equipment, namely a laboratory-scale flow loop that simulates several STES reservoir conditions, and a water well injectivity impairment test stand that can be used for inline testing of functional STES injection streams in the field. The geochemical modeling assessment has resulted in a preliminary selection of the model most pertinent to STRES and in recommendations for FY 1981 refinements. The effects of temperature and time on permeability and the compressibility of unconsolidated sands are being studied at Pacific Northwest laboratory and Terra Tek. Preliminary results indicate that significant permeability reduction might be expected at elevated temperatures. Particulate plugging may be responsible for this lower permeability, but additional study is required before final conclusions can be made.

14122 (CONF-801128—, pp 96-102) **Flow facility development and laboratory analysis.** Cooley, C.H.; Owen, L.B.; Blair, C.K.; Banik, G.J. (Terra Tek, Inc., Salt Lake City, UT). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

A key element in the assessment of Aquifer Thermal Energy Storage (ATES) processes is the determination of aquifer response to cyclical production and injection of hot water. There is also a need to establish baseline injectability data, in conjunction with pilot demonstration projects, and to determine the impairment potential of factors such as thermal cycling, time-dependent water chemistry changes and the impact of any chemical treatment schedules that may be required to control corrosion, biological degradation or scaling of the ATES system. Laboratory and field testing equipment are being developed that will be used in the assessment of subsurface storage reservoir response to long-term ATES utilization.

14123 (CONF-801128—, pp 103-106) **Numerical simulation of aquifer thermal energy storage facilities.** Kincaid, C.T. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Progress is reviewed for that portion of the Seasonal Thermal Energy Storage (STES) Program which involves the numerical simulation of aquifer thermal energy storage (ATES) systems. The Pacific Northwest Laboratory (PNL) has been involved in the modification of an isothermal ground-water code to include energy transport. Washington State University personnel are involved in modification and application of Intera's Deep Well Disposal Model (DWDM). Means are being sought to quantify the adequacy of mesh and time discretizations for the finite element model of coupled fluid, energy, and solute transport (CFEST). Meshes developed from flow net grids appear to be promising and will be pursued during FY 1981. Both CFEST and Intera's DWDM codes will be applied to the Auburn University experiment during FY 1981.

14124 (CONF-801128—, pp 108-114) **Aquifer thermal energy storage studies at LBL in 1980.** Tsang, C.F. (Univ. of California, Berkeley). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The Aquifer Thermal Energy Storage (ATES) program at Lawrence Berkeley Laboratory during 1980 is renewed. The four major lines of work were: To solicit appropriate articles and edit them for a quarterly International ATES Newsletter; to perform ATES generic studies; to carry out field-specific planning and simulation studies; and to improve modeling techniques. These four tasks formed a well-balanced program of work to stimulate interest and information exchange in this field, to provide technical support

to field projects, and to develop techniques that may be useful for industrial applications of this concept.

14125 (CONF-801128—, pp 117-121) **Nonaquifer seasonal thermal energy storage.** Blahnik, D.E. (Pacific Northwest Lab., Richland, WA). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

An initial survey, evaluation, and selection of potential nonaquifer seasonal thermal energy storage (STES) concepts was completed, and the results were incorporated in a formal report. The preliminary evaluation indicated that sensible heating and cooling concepts had the most near-term promise because the state-of-the-art is the most advanced. In general, the best STES concepts use temperatures less than 95°C, low-cost storage media (water and rock), construction with earth, good insulation, and economies of large scale. The most promising concepts should be more thoroughly evaluated, especially for their cost and thermal effectiveness.

14126 (CONF-801128—, pp 137-146) **CAES/FBC studies.** Lessard, R.D.; Blecher, W.A. (United Technologies Research Center, East Hartford, CT). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Highlights are presented of a recently completed program to assess the technical and economic feasibility of advanced concepts for generating peak-load electric power from a compressed air energy storage (CAES) power plant incorporating a coal-fired fluid bed combustor (FBC). Specifically, progress made in the study program is reviewed and includes: a preconceptual design of a CAES power plant utilizing a pressurized fluid-bed combustor (PFBC); an economic analysis based upon the PFBC/CAES power plant preconceptual design; and an investigation of the part-load transient capabilities of the power plant. In addition the conclusions, derived from these phases of the study program are presented and indicate that a PFBC/CAES power plant could produce competitive peak- and mid-range electrical energy, and that a CAES power plant with an open-bed PFBC appears to have no equipment-related constraints which would prevent the power plant from being responsive to utility requirements for a peak- or mid-range power plant.

2509 Batteries

REFER ALSO TO CITATION(S) 14368, 14371, 14372

14127 **(BMFT-FB-T—80-151) Development of a lead-acid battery with high energy and power density.** Baufeldt, K.E.; Borger, W.; Braeutigam, R. (Bundesministerium fuer Forschung und Technologie, Bonn-Bad Godesberg (Germany, F.R.)). Dec 1980. 221p. (In German). NTIS (US Sales Only), PC A10/MF A01.

The energy density of lead-acid cells has been increased to more than 50 Wh_s/kg by two different ways: first, by means of forced electrolyte flow through the active materials, and second, by means of a new construction method with a chequered electrode arrangement based on minimized electrolytic and electronic conduction paths, and on optimized volume/surface area proportion. This cell shows particularly at higher loads an outstanding capacity behaviour; at the one-hour discharge the energy density is twice that of the MAN-bus cell. From present experience it is concluded that the energy density of the lead-acid system can be increased to 60 Wh_s/kg. As to the cycle life of the positive electrode, the antimony-free effect causing the premature failure of cells in cycle tests, can now be explained on the basis of a model. As a consequence, it will be possible to apply corrosion-resistant grid materials without antimony also for cells specifically designed for repeated deep discharges. Due to an improved understanding of the expander mechanism, the expander depot and a method of rejuvenating negative plates were developed, which failed because of sintering, using special expander materials. This procedure has been applied successfully to a MAN-bus battery. With reference to the battery periphery, experience on a H_2/O_2 gas recombination device has resulted in a hermetically sealed lead-acid cell for electric vehicles. For the remote control of the state of charge an indicator with automatic temperature compensation has been developed.

14128 **(DOE/CH/10026—T4) Battery resource assessment. Interim report No. 1. Battery materials demand scenarios.** Sullivan, D. (Hittman Associates, Inc., Columbia, MD (USA)). Dec 1980. Contract AC02-80CH10026. 54p. NTIS, PC A04/MF A01.

Projections of demand for batteries and battery materials between 1980 and 2000 are presented. The estimates are based on existing predictions for the future of the electric vehicle, photovoltaic, utility load-leveling, and existing battery industry. Battery demand was first computed as kilowatt-hours of storage for various types of batteries. Using estimates for the materials required for each battery, the maximum demand that could be expected for each battery material was determined.

14129 **(DOE/CH/10026—T5) Battery resource assessment. Subtask II.5. Battery manufacturing capability recycling of battery materials. Draft final report.** Pemsler, P. (Hittman Associates, Inc., Columbia, MD (USA)). Feb 1981. Contract AC02-80CH10026. 40p. NTIS, PC A03/MF A01.

Studies were conducted on the recycling of advanced battery system components for six different battery systems. These include: Nickel/Zinc, Nickel/Iron, Zinc/Chlorine, Zinc/Bromine, Sodium/Sulfur, and Lithium-Aluminum/Iron Sulfide. For each battery system, one or more processes has been developed which would permit recycling of the major or active materials. Each recycle process has been designed to produce a product material which can be used directly as a raw material by the battery manufacturer. Metal recoverabilities are in the range of 93 to 95% for all processes. In each case, capital and operating costs have been developed for a recycling plant which processes 100,000 electric vehicle batteries per year. These costs have been developed based on material and energy balances, equipment lists, factored installation costs, and manpower estimates. In general, there are no technological barriers for recycling in the Nickel/Zinc, Nickel/Iron, Zinc/Chlorine and Zinc/Bromine battery systems. The recycling processes are based on essentially conventional, demonstrate technology. The lead times required to build battery recycling plants based on these processes is comparable to that of any other new plant. The total elapsed time required from inception to plant operation is approximately 3 to 5 y. The recycling process for the sodium/sulfur and lithium-aluminum/sulfide battery systems are not based on conventional technology. In particular, mechanical systems for dismantling these batteries must be developed.

14130 **(EPRI-EM—1698) Electromagnetic testing of ceramic materials: a feasibility study. Final report.** Shen, L.Y.L.; Johnson, D.P. (Reluxtrol, South San Francisco, CA (USA)). Feb 1981. 35p. NTIS, PC A03/MF A01.

This study confirmed and more clearly defined the anomalously large crack signal and lift-off signals obtained from certain ceramics with focused field electromagnetic testing methods. The anomalously large crack signals observed in conducting ceramics are explained in terms of the bulk electrical conductivity being lower than the near surface conductivity. The anomalously large lift-off signals obtained from semi-conducting and insulating ceramics are explained in terms of capacitance coupling through the test material. The feasibility of using focused field electromagnetic test methods in β''-aluminas was examined. Cracks were detected in β''-aluminas but the dependence of crack detection upon crack size and conductivity was not determined. Conductivity differences were also measured. A method for enhancing crack detection in β''-alumina by increasing the surface conductivity relative to the bulk conductivity is suggested.

14131 **(ORNL/TM—7639) Physical chemistry of molten salt batteries. Final report for period October 1, 1979-September 30, 1980. Current-induced composition gradients in molten LiCl-KCl.** Braunstein, J.; Cantor, S.; Vallet, C.E. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01.

Current induced composition gradients were demonstrated in the molten LiCl-KCl eutectic mixture, the electrolyte of an LiAl/LiCl-KCl/FeS/sub x/ battery. The gradients were produced by electrolysis of the salt between LiAl electrodes at currents of 50 to 100 mA cm^{-2}, and quenching. Analysis of composition profiles in

quenched samples was by atomic absorption spectroscopy, which gave good precision, and by x-ray fluorescence spectroscopy in a scanning electron microscope (SEM/EDX), which gave good distance resolution. Work is in progress to improve the precision of the SEM/EDX measurements to that demonstrated in model systems.

14132 **(PB—80-808629) Battery electrolytes. 1972-April, 1980 (citations from the NTIS Data Base). Report for 1972-April 80.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 215p. NTIS PC N01/MF N01.

Many types of solid, liquid and gaseous battery electrolytes are described and analyzed in the cited abstracts. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery life, efficiency, and maintenance characteristics are also delineated. (Contains 196 citations)

14133 **(PB—80-808637) Battery electrolytes. 1970-April, 1980 (citations from the Engineering Index data base). Report for 1970-April 80.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 37p. NTIS PC N01/MF N01.

Many types of solid, liquid and gaseous battery electrolytes are described and analyzed in the cited abstracts. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery life, efficiency, and maintenance characteristics are also delineated. (Contains 29 citations)

14134 **(PB—80-808645) Battery electrolytes. 1972-April 1980 (citations from the International Aerospace Abstracts Data Base). Report for 1972-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 68p. NTIS PC N01/MF N01.

Many types of solid, liquid, and gaseous battery electrolytes are considered in the cited reports. Battery design, construction, and use, employing the listed electrolytes, are discussed. Battery life, efficiency, and maintenance characteristics are also delineated. (Contains 53 citations)

14135 **(PB—80-812340) Nickel cadmium batteries. 1977-June, 1980 (citations from the NTIS Data Base). Report for 1977-Jun 80.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 141p. NTIS PC N01/MF N01.

The design, fabrication, components, testing, and assembly of nickel cadmium batteries are covered in the bibliography. The majority of these citations deal with the development of power supplies for aircraft and spacecraft. (This updated bibliography contains 135 abstracts, 19 of which are new entries to the previous edition.)

14136 **(PB—80-813363) Lead batteries. 1964-June 1980 (citations from the NTIS Data Base). Report for 1964-June 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 204p. NTIS PC N01/MF N01.

The design, development, components, fabrication, chemistry, and testing of lead batteries are cited in this compilation of Federally-funded research. Specific applications for spacecraft, consumer products, and electric vehicles are covered. Studies on lead recovery from battery scrap are covered. Several abstracts on lead toxicity in industrial plants are also cited. (This updated bibliography contains 199 citations, 36 of which are new entries to the previous edition.)

14137 **(PB—80-813371) Lead batteries. 1977-June 1980 (citations from the Engineering Index Data Base). Report for 1977-June 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 159p. NTIS PC N01/MF N01.

Worldwide research on lead battery components, charging, corrosion, and testing is cited. The majority of studies concern battery use in electric vehicles. Studies on lead recovery from battery scrap and air pollution at battery factories are also included. (This updated bibliography contains 155 citations, 40 of which are new entries to the previous edition.)

14138 **(UCRL—85448) Aluminum-air battery for automotive propulsion.** Cooper, J.F.; Behrin, E. (Lawrence Livermore National Lab., CA (USA)). Dec 1980. Contract W-7405-ENG-48. 21p. (CONF-801242—3). NTIS, PC A02/MF A01.

From Electric and hybrid vehicle advanced technology seminar; Pasadena, CA, USA (8 Dec 1980).

Research on the development of aluminum-air batteries which will be used in energy efficient, economical electric vehicles is reviewed with information on the research strategy, performance characteristics of aluminum-air cells, vehicle design, and the net energy required and energy costs for producing and operating Al-air batteries. The aluminum-air battery is being developed to provide a propulsion source for a general-purpose electric vehicle that has the acceleration, range, and rapid-refueling characteristics of current automobiles. The objective is petroleum conservation in a time frame in which synthetic liquids will enter large scale production. Two parallel development paths are being pursued. These involve hardware developments using model electrodes, and research directed toward cost-effective electrodes. The project is currently directed toward developing rapidly-refuelable single cells. Successful development of battery hardware and electrodes would make possible a general-purpose vehicle with costs and energy consumption similar to advanced ICE vehicles using fuels synthesized from coal, but with the advantages of a broad primary energy base and an emissionless vehicle. (LCL)

14139 **Evaluation of high temperature $LiAlTiS_2$ cells.** Tomczuk, Z.; Anderson, K.E.; Vissers, D.R.; Roche, M.F. (Argonne Natl Lab, Ill). *Journal of the Electrochemical Society ;* **127**: No. 9, 1881-1885(Sep 1980).

The electrochemistry of the TiS_2 electrode of $LiTiS_2$ cells in molten LiCl-KCl was found to be similar to that in room temperature cells. The emf curve for Li/sub x/TiS_2(0 less than or equal to x less than or equal to 1) was nonlinear and could be treated in terms of a regular solution model. The effect of TiS_2 electrode thickness was investigated, and the results indicated that good utilization (approximately 70%) could be obtained with thick (0.66 cm) TiS/sub 2/ electrodes. The performance of engineering-scale $LiAlTiS_2$ cells (77-142 A-hr capacities) is investigated. 17 refs.

29 ENERGY PLANNING AND POLICY

14140 **(DOE/EIA—0249(80)) EIA data collection forms.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Nov 1980. 72p. NTIS, PC A04/MF A01.

This quarterly directory contains abstracts of 168 forms used by the Energy Information Administration (EIA) as tools in their information-gathering process. Each abstract includes the following: frequency of submission of the form, the respondent group, the units of measure, and the authority under which the data are collected. The abstracts are arranged by form number. There is an index which lists forms by the type of energy source surveyed, a listing of the public laws referenced in the abstracts, and a listing of the titles of the resulting publications indicated by DOE/EIA number under certain abstracts. Each issue will supersede previous issues.

14141 **(PB—80-812324) Forecasts of energy technology. 1974-1979 (citations from the International Aerospace Abstracts Data Base). Report for 1974-Dec 79.** Gallagher, M.K. (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jul 1980. 60p. NTIS PC N01/MF N01.

The cited articles from worldwide literature concern forecasts of the development of energy technology. Stressed are forecasts relating to new energy sources such as hydrogen-based energy, solar energy conversion and to nuclear energy and coal utilization. Economic analyses of various energy conversion techniques are included. (This updated bibliography contains 183 citations, 47 of which are new entries to the previous edition.)

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 14138, 14160, 14161, 14185, 14186, 14190, 14197, 14200, 14214, 14228, 14237, 14244, 14245

14142 (AD-A—087483) A decision support system for energy policy analysis. Technical report. Pick, R.A.; Whinston, A.B.; Koehler, G. (Purdue Univ., Lafayette, IN (USA). Krannert Graduate School of Management). Jul 1980. 26p. NTIS, PC A03/MF A01.

This paper proposes a new approach to energy policy analysis. After a brief review of energy models, a novel decision support system based upon a modal data base, and a collection of programs which operate upon the data base. The paper concludes with an illustrative example.

14143 (DOE/EIA/AR—0255) Electric utilities in the 1970's: financial practices and performance. Analysis report. Connor, E.G. (Department of Energy, Washington, DC (USA). Energy Information Administration). Dec 1980. 54p. NTIS, PC A04/MF A01.

Characteristics of financial factors that are controlled by regulatory bodies and which have a significant impact upon the financial condition of investor-owned electric utilities are explained. Specifically, the report emphasizes matters affecting a utility's cost of service such as: the composition of operating costs; normalization versus flow-through accounting (particularly where depreciation and the investment tax credit are concerned); the rate base; and construction work in progress and the related allowance for funds used during construction. Also reviewed is aggregate investor-owned utility financial data for the 1970 to 1977 period. A selected bibliography of 22 items is appended. 3 tables.

14144 (DOE/EIA/TR—0245) Procedures for analyzing data for use in models. Herbert, J.H. (Department of Energy, Washington, DC (USA). Energy Information Administration). Jun 1980. 25p. NTIS, PC A02/MF A01.

An approach to energy-data verification is presented, with specific methodology discussed. By employing data-verification techniques and methodologies, specific problem areas in data bases are discovered. The applications section is augmented by illustrative examples taken from the entitlement program. Four steps are suggested to accomplish data verification - hypotheses, technique selection, model formation, and interpretation.

14145 (ORNL—5707) Specifications of the equations for LEAP Model 22C. Goldstein, M.; Alsmiller, R.G. Jr.; Barish, J. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 90p. NTIS, PC A05/MF A01.

This report describes the equations implemented in the Long-Term Energy Analysis Program (LEAP) Model 22C. The equilibrium equations of each of the processes contained in the LEAP Model 22C are specified, and the interrelations of the various equations are discussed. No attempt is made to derive the equations or to discuss their validity from an economic point of view.

14146 (ORNL—5742) Approach to evaluating energy-economy models. Weisbin, C.R.; Peelle, R.W.; Loebl, A.S. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 76p. NTIS, PC A05/MF A01.

The increasing importance of models that stress the energy portion of the economy has created the demand for evaluation, by other than the model developer, to determine the strengths and weaknesses of a model with respect to the needs of the intended user. The literature describing how evaluations should be performed shows agreement on several basic components of the evaluation process, but at the same time is confusing because, although the same words may be used to describe these components, they often have different meanings. Although the models of interest are quantitative and the corresponding computer programs yield numerical results, published guidelines on model evaluation have lacked operationally defined checkpoints that can be used to summarize concisely and quantitatively the status of knowledge at a given time. A set of guidelines is developed for evaluating energy-economy models; the components of a thorough model evaluation are defined in an operational manner. Quantitative measures based on sensitivity and uncertainty analysis of results important to the user are included. Examples of the various components are drawn from the literature and from evaluation by Oak Ridge National Laboratory of the Long-Term Energy Analysis Program (LEAP) used by the Energy Information Administration for making projections to year 2020 included in that agency's 1978 Annual Report to Congress. Possible paths for future development of evaluation techniques are indicated, particularly those for which evaluation components must be more-strictly defined after further practical experience is gained.

14147 (PB—80-168420) Energy policy in a small open economy: The case of Sweden. Final report. Bergman, L. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). 1978. 62p. NTIS PC E03/MF E03.

In this paper a multisectoral model of economic growth is developed and used for analysis of the economic impact of an energy strategy proposed by the Swedish government. According to the proposal, Sweden should aim at reducing energy consumption growth from a postwar average of 5% per annum to 2% per annum between 1973 and 1985 and to zero growth thereafter. The model allows substitution between energy and other factors of production, and it has explicit export and import functions.

14148 (PB—80-168990) Simulation of macroeconomic scenarios to assess the energy demand for India (SIMA). Final report. Parikh, J.K.; Parikh, K.S. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). 1979. 59p. NTIS PC E03/MF E03.

The purpose of this report is to project alternative future energy demand scenarios consistent with economic developments and possible energy supply scenarios. It is also to examine the interaction between the increased costs of energy and economic development, which may be important for developing countries where capital accumulation and imports generally constitute the major constraints on development.

14149 (PB—80-169030) Assessment of alternative energy/environment futures for Austria: 1977-2015. Final report. Foell, W.K.; Dennis, R.L.; Hanson, M.E.; Hervey, L.A.; Hoelzl, A. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). 1979. 184p. NTIS PC E07/MF E07.

This report presents the major results of the 15-month, Austrian case study, which examines alternative energy futures and strategies for Austria and some of their environmental implications. A secondary objective is the development of appropriate concepts and methods for energy/environment management and policy design in Austria.

14150 (PB—80-175383) Land use, energy flow, and decision making in human society. Volume 2. Regional modeling, technical reports. Annual report No. 2. (California Univ., Davis (USA). Interdisciplinary Systems Group). Jan 1973. 141p. NTIS, PC A07/MF A01.

This volume consists of six technical reports or reprints published during the past year as part of a research project to develop simulation models of land use and energy flow in human society, with special attention to the State of California. The articles are: World Dynamics--A Note; Parameter Identification and Dynamic Models of Socioeconomic Phenomena; Projecting Global Energy Demand; A Blueprint for Survival; An Empirically Based Birth Rate Model for Use in Large Systems Studies of Society; and Legislative Analysis--Two Approaches.

14151 (PB—80-813041) Energy supply and demand modeling. 1964-June 1980 (citations from the NTIS Data Base). Report for 1964-June 1980. Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 186p. NTIS PC N01/MF N01.

The use of energy models to estimate the supply and demand of electricity, oil, natural gas, coal, and petroleum products on national, regional, and state levels is discussed. The models cover residential, commercial, and industrial supply and demand;

the impact of economic conditions on demand; energy use alternatives; and optimal allocation of regionally produced energy resources. Abstracts pertaining to design and development of energy models are included. (This updated bibliography contains 178 citations, 35 of which are new entries to the previous edition.)

14152 **Role of regional modeling in Federal policymaking.** Lyall, K. . (Dept. of Housing and Urban Development, Washington, DC). pp 13-18 of Modeling the multiregional economic system: perspectives for the eighties. Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

The role that regional modeling is likely to play in Federal policymaking in the foreseeable future is not bright. Regional or subnational models of any kind have been employed very little in the daily business of policymaking, program design, or administration in most Federal agencies. The two conspicuous exceptions to this record are the Department of Defense where strategic simulations, including some very sophisticated interactive models, are well established, and the Department of Health, Education and Welfare where regional modeling has been used primarily for the process of program design or revision, for example, in the welfare-reform debate of 1978. Regional models have scarcely been used at the Department of Housing and Urban Development (HUD). The reasons are discussed and then types of policy questions that need be answered in the future by models are noted. What this means for future regional modeling is discussed.

14153 **Priorities for multiregional modeling.** Crow, R.T. pp 19-21 of Modeling the multiregional economic system: perspectives for the eighties. Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

Clients and applications of multiregional models are discussed, emphasizing the investment-planning dimension. Two major areas of public-investment planning in which multiregional modeling plays an important role are transportation-system planning and energy-facility planning. In the discussion on model specifications, it is noted that regional models in general, including multiregional models, have paid far too much attention to the demand side, and only partially at that. More should be done to represent the supply side. An approach in which equal emphasis is given to both supply and demand for regional economic modeling is a top-down (TD) system which relies upon the national economy to determine the overall level of capital formation which is then allocated across regions by locational principles. Another area deserving attention is that of nonmanufacturing industries being placed on approximately the same footing as manufacturing. Regional modeling should also in general be increasingly concerned with modeling the implications of resource constraints, environmental restrictions, and technology.

14154 **(PB—80-168719) MEDEE (Modele d'Evolution de la Demande d'Energie) 2: A model for long-term energy demand evaluation. Final report.** Lapillonne, B. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 53p. NTIS PC E03/MF E03.

This report describes a simulation model, MEDEE 2, designed to evaluate the long-term energy demand of a country, in combination with a scenario description of the main aspects of the country's social, economic, and technological evolution. This approach considers in a detailed way a national energy demand pattern and breaks down the total demand in a multitude of end-use categories (e.g., residential space heating, service sector cooling, gasoline for intercity cars). The influence on energy demand of changes in social needs, economic growth, government policies, or technologies, especially in the present context of high energy prices is taken into account. In addition, the model makes possible the identification of the potential market (i.e. maximum demand that can be technically met) of each final energy form (e.g. electricity, coal, gas, solar, oil products, and district heat).

14155 **(PB—80-169642) The dynamics of energy systems and the logistic substitution model. Final report.** Marchetti, C.; Nakicenovic, N. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 86p. NTIS PC E04/MF E04.

This work is dedicated to the empirical testing and theoretical formulation of an invariant, the logistic learning curve, as it applies to the structural evolution of energy systems and systems related to energy, such as coal mining. The great success of the model in organizing past data and the insensitivity to major political and economic perturbations of the structures obtained seem to lend great predictive power to this invariant. A total of about 300 cases was examined, the USA being particularly well represented. Since supertankers have made the energy system a world system, the case of the world as a whole was given special attention for its political and resource implications.

14156 **(PB—80-176209) The economic impact model. Final report.** (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 80p. NTIS PC E04/MF E04.

An initial version of the economic impact model (IMPACT) was developed at the Siberian Power Institute in Irkutsk. The model was originally designed to study the influence of the development of the energy sector on energy-related sectors of the national economy. Subsequently, the model was brought to IIASA where it was revised to focus on the identification and comparison of long-term regional and global energy strategies in the transition period of 15 to 50 years from now. The possible influence of any given energy strategy on the economy is evaluated in terms of capital investment, manpower, materials, and natural resources that are needed to develop not only the energy supply system (ESS) but also the energy related sectors of the economy. This report describes IMPACT as it exists at IIASA, explains the computer program, and includes a user guide for implementing this method.

2902 Economics And Sociology

14157 **(PB—80-170293) Problemas energeticos en paises subdesarrollados (energy problems in developing countries).** (Universidad Centroamericana Jose Simeon Canas, San Salvador (El Salvador)). Feb 1979. 175p. NTIS, PC A08/MF A01.

The need for creating energy technicians at post graduate levels in Mexico and other countries is explored. A history and description of OPEC agreements and reflections on the world economy are presented. Tables, graphics, illustrations, and a bibliography are included.

14158 **(PB—80-174345) Public reaction to proposed energy facilities: A sociological analysis. Final technical report .** Clemente, F.; Hastings, M.; Cawley, M.; Ferrar, T.A. (Pennsylvania State Univ., University Park (USA). Center for the Study of Environmental Policy). Sep 1978. 185p. NTIS, PC A09/MF A01.

This study provides an interpretation of the role and behavior of key groups in the Pennsylvania Energy Park Controversy where unfavorable public reaction developed concerning the concentration of electrical generating capacity at a single geographic site. The energy parks proposed for the State were to consist of several power plants, both nuclear and coal-fired. Ten potential sites within Pennsylvania, all predominantly rural, were identified as possible construction sites. A methodology was used which incorporated public opinion towards these sites gathered from information meetings, letter writing, and from a variety of perspectives within the context of the issue.

14159 **(PB—80-193568) The comparative effects of energy technologies on employment. Staff report (final).** Lerner, L.J.; Posey, F.H. (California Energy Commission, Sacramento (USA)). Nov 1979. 122p. NTIS, PC A06/MF A01.

This study analyzes the relative contribution of nuclear, coal, and oil power generation technologies, the addition of insulation to existing residences and solar water heating to overall state and na-

tional job opportunities. Direct, indirect, and induced jobs which result from the constructing and operation of these alternative energy technologies are compared in terms of equivalent costs and equivalent energy produced or conserved. Employment per dollar of expenditure for each energy technology is also compared to employment per dollar in other broad sectors of the economy.

14160 **Modeling the multiregional economic system: perspectives for the eighties.** Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980). 315p. (CONF-7906196—).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

In this proceedings, the editors attempted to cover the range from the data problems for multiregional modeling to the underlying theory, the structure of some empirical models, and finally the applications. In addition to notes with each paper, an extensive overall list of references is compiled at the end of the volume. A separate abstract was prepared for each of the 21 papers for Energy Abstracts for Policy Analysis(EAPA); six abstracts were selected for Energy Research Abstracts (ERA).

14161 **Multiregional modeling in policy analysis.** Bolton, R. (Williams Coll., Williamstown, MA). pp 255-283 of Modeling the multiregional economic system: perspectives for the eighties. Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

Some general theoretical points are reviewed about the use of multiregional input-output (I-O) and econometric models for policy analysis, and then comments are made on important characteristics of several operational multiregional models in light of the general points. As examples of how models might be used in policy analysis, five kinds of Federal fiscal policies and five currently operational multiregional models are described. How each of the models might be used to simulate each of the policies is explained. From this review, some conclusions about each model, and also about the general possibilities of policy analysis with the models now available are drawn. The five models are IDIOM, the Leontief balanced I-O model, developed by Stephen Dresch; Institute for Poverty Research version of the Polenske MRIO (multiregion input-out) model, developed by Robert Haveman and Frederick Golladay; Multiregion, developed by Richard Olsen at Oak Ridge National Laboratory; Multiregional multiindustry forecasting model, developed by Curtis Harris, at the University of Maryland; and national regional impact evaluation system (NRIES), developed at the Bureau of Economic Analysis (BEA) by Kenneth Ballard. Some comments are made on a leading proprietary model that of Chase Econometric Associates, on the Milne-Adams-Glickman (MAG) model developed at Wharton, and the model now being developed by Wharton for the Electric Power Research Institute.

14162 **(PB—80-180607) Resources and decisions.** Lang, J.M.; Fisher, D.L. (Wisconsin Univ., Madison (USA). Leonardo Scholars). [nd]. 178p. NTIS, PC A09/MF A01.

An interdisciplinary study analyzed trends in resource supply and consumption in the United States, the institutions established to deal with these trends, and ways in which resource policy might be realigned. The investigation focused on three representative resources: copper, a nonrenewable material; wheat, a renewable resource; and energy, the lifeblood of all material production. Multiple aspects in such areas as processing, consumption, and law were probed in depth. From these studies emerged a focus for larger issues which are presented in detail. These include limitations of social organizations to direct policy change, the need for careful scrutiny of supply and demand forecasts, bad bargains resulting from hasty decisions in longterm policies, continuing conflicts over resource usage when material and energy shortages persist, conservation through new consumption patterns of material and energy, reduction in alternative sources of energy and material resulting from reliance on monopolistic economies of scale, and the greater efficacy of changing policy by numerous small steps rather than by sweeping ones. Ethical issues were considered, particularly U.S. responsibility to the well-being of poorer countries.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 13468, 13862, 14333, 14338, 14367, 14656, 14722, 14768, 14794, 14798, 14892, 14895

14163 **(P—700-80-003) Recommendations for earthquake hazard reduction programs during fiscal years 1980/81-85/86.** (California Energy Commission, Sacramento (USA)). Mar 1980. 73p. Energy Resources Conservation and Development Commission, Sacramento, CA.

The purpose of the study is to provide the Seismic Safety Commission with recommendations for programs and activities related to earthquake hazard reduction that the CEC staff believes should be implemented or investigated over the next five years (FY 80/81 - 85/86). This report presents CEC staff preferences for earthquake hazard reduction programs and activities, identifies potential issues related to implementation of these programs, outlines existing seismic safety policies, laws, and standards which relate to the facility types considered, and discusses what has been done in the past, and is currently being done to achieve earthquake hazard reduction by the various utilities and regulatory agencies. The scope of the study is limited to energy and related facilities. Facility types addressed include: (1) electrical systems (existing and planned); (2) nuclear power plants; (3) LNG facilities under consideration in California; and (4) toxic waste disposal facilities/sites.

14164 **(PB—80-178759) The benefits of air and water pollution control: a review and synthesis of recent estimates. Final report.** Freeman, A.M. III. (Bowdoin Coll., Brunswick, ME (USA)). Dec 1979. 191p. NTIS, PC A09/MF A01.

Objectives of this study are to provide a critical review of previous studies which have attempted to estimate air and water pollution control benefits in monetary terms or which might provide an empirical basis for such an estimate; to explain why the estimates are so different; to recalculate benefit estimates whenever possible on the basis of common assumptions concerning price level, base period, degree of cleanup, and imputed values in order to compare the different estimates.

14165 **(PB—80-182504) The White House celebration of the beginning of the second environmental decade.** (Executive Office of the President, Washington, DC (USA). The White House Office). Feb 1980. 12p. NTIS, PC A02/MF A01.

The report is the address on the environment by the President of the United States.

14166 **(PB—80-192479) Primary aluminum - background information for promulgated amendments.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Mar 1980. 33p. NTIS, PC A03/MF A01.

This document summarizes and responds to comments submitted by the public on the proposed amendments to the standards of performance for new primary aluminum plants. The standards and amendments are intended to limit emissions of gaseous and particulate fluorides into the atmosphere. The document also presents the final environmental, economic, and energy impacts of the final amendments.

14167 **Radiation protection standards and (issues and concerns).** Carwell, H.V. (Dept. of Energy, Oakland, CA). *Journal of the National Technical Association ;* **54**: No. 3, 51-53, 56-57(Sum 1980).

Today, the public is becoming increasingly aware and concerned about risks associated with exposure to radiation from the nuclear industry. The intent of this discussion is to provide a clarification of factors used to determine radiation exposure risks. Assumptions to determine acceptable risks will also be identified. Issues and concerns surrounding the radiation protection standards and policy will be emphasized.

2904 Natural Resources

14168 (PB—80-195324) International forestry in the US Department of Agriculture. Staff report. Winters, R.K. (Economics, Statistics, and Cooperatives Service, Washington, DC (USA). National Economics Div.). Jan 1980. 66p. NTIS, PC A04/MF A01.

The U.S. Forest Service and schools of forestry developed principles of forest and range conservation, regeneration, multiple use, and sustained yields as a means of restoring and maintaining U.S. forest productivity and protecting land and water resources. Since 1940 the U.S. Forest Service has been continuously providing technical assistance to other countries in an effort to transplant these principles and assist in the establishment of viable national forestry programs. The progress and problems of this effort are seen through the eyes of the participants.

14169 (PB—80-196108) Estimates of the costs of renewable energy technologies for New York State. Final report, January-July 1979. Pleatsikas, C.; Funkhouser, D. (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). Jul 1979. 487p. NTIS, PC A21/MF A01.

This study of renewable and indigenous resources in New York State was funded by the New York State Energy Research and Development Authority. The results are a compendium of estimates of costs associated with the energy produced by solar, wind, small hydropower, geothermal, biomass, and resource recovery technologies. Where possible, data specific to New York were employed or national or regional data were adjusted to reflect the climatological, geographical, and other basic circumstances in the State.

14170 (UWRL-P—80/04) Use of saline water in energy development. Israelsen, C.E.; Adams, V.D.; Batty, J.C.; George, D.B.; Hughes, T.C.; Seierstad, A.J.; Wang, H.C.; Kuo, H.P. (Utah State Univ., Logan (USA). Utah Water Research Lab.). Jun 1980. 142p. Utah State Univ., Logan $6.00.

Maps were made of the Upper Colorado River Basin showing locations of coal deposits, oil and gas, oil shale, uranium, and tar sand, in relationship to cities and towns in the area. Superimposed on these are locations of wells showing four ranges of water quality; 1000 to 3000 mg/l, 3000 to 10,000 mg/l, 10,000 to 35,000 mg/l, and over 35,000 mg/l. Information was assembled relative to future energy-related projects in the upper basin, and estimates were made of their anticipated water needs. Using computer models, various options were tested for using saline water for coal-fired power plant cooling. Both cooling towers and brine evaporation ponds were included. Information is presented of several proven water treatment technologies, and comparisons are made of their cost effectiveness when placed in various combinations in the power plant makeup and blowdown water systems. A relative value scale was developed which compares graphically the relative values of waters of different salinities based on three different water treatment options and predetermined upper limits of cooling tower circulating salinities. Coal from several different mines was slurried in waters of different salinities. Samples were analyzed in the laboratory to determine which constituents had been leached from or absorbed by the coal, and what possible deleterious effects this might have on the burning properties of the coal, or on the water for culinary use or irrigation.

14171 Management summary report. Auditing and financial system. Feldmiller, W.H. Lakewood, CO; U.S. Geological Survey Conservation Division (1980). 67p. (NP—25250). $3.00.

Increased leasing of Federal lands for energy exploration will add to the regulatory and administrative responsibilities of the USGS's Conservation Division. Similar responsibilities for Indian lands will arise. The objectives of the Conservation Division is to reduce the regulatory burden on industry while effectively and efficiently discharging its responsibility. This Management Summary Report represents the completion of the Preliminary Systems Design of the Auditing and Financial System, and is the first phase of the Improved Royalty Management Program (IRMP). Work reported includes: a Functional Specifications Report; Technical Specifications Report; Installation Plan; and a cost/benefit analysis. The potential benefits to be realized from the IRMP are significant and include: increased royalty receipts; more timely availability of funds; increased productivity of personnel; reduced regulatory burden on private industry; tighter security over information collected; reduced exposure to fraud and abuse; and better control over activities and funds.

14172 Technical specifications report. Auditing and financial system. Feldmiller, W.H. Lakewood, CO; U.S. Geological Survey Conservation Division (1980). 244p. (NP—25251). $6.00.

The U.S. Geological Survey's Conservation Division is responsible for regulating the development of mineral resources on Federal leased lands and Indian reservations and for collecting the rents and royalties due from these lands. The objective of the Division is to reduce the regulatory burden on industry while effectively and efficiently discharging its responsibility. The development of the Improved Royalty Management Program (IRMP) is a major step in accomplishing these goals. The completion of the technical design of the first phase in the development of the IRMP is reported. How the Auditing and Financial System (AFS) will operate from a data-processing viewpoint is described, as well as how the system will perform the functions identified in the AFS Functional Specifications Report. Information is provided on the following: Systems Components (hardware, software, organizations, and security; Data Base Design; Overall System Flow; Batch Processes; Online Processes; System Testing; Conversion; and Resource Requirements (performance, computer storage; timings, terminals, transmission, datapoint configuration; personnel).

14173 Installation plan report. Auditing and financial system. Feldmiller, W.H. Lakewood, CO; U.S. Geological Survey Conservation Division (1980). 110p. (NP—25252).

The U.S. Geological Survey's Conservation Division is responsible for regulating the development of mineral resources on Federal leased land and Indian reservations and for collecting the rents and royalties due from these lands. Development of the Improved Royalty Management Program will help carry out these functions, and a systems design of the Auditing and Financial System (AFS) is developed. Installation of many facets of the AFS will consider some of the problems expected in implementing improvements in the royalty reporting and paying process. The introductory chapter considers changes in regulations, changes in reporting, USGS organizational changes, and computer-system conversions. It also provides a brief summary of the considerations USGS will address in each of these areas. The detailed approach for converting the method of reporting and paying royalties is presented. A description of the file-conversion approach explains how the new system information is obtained. The impact of the USGS organizational changes on personnel in both the old and new offices is discussed. The steps to convert the computer system and the effort required are summarized.

14174 Functional specifications report. Auditing and financial system. Lakewood, CO; U.S. Geological Survey Conservation Division (1980). 243p. (NP—25253).

The accelerated growth of the domestic energy industry has made the current USGC Royalty Collection System critically outmoded; problems incurred are discussed. A work group developed a long-range approach, consisting of three phases and a five-year plan. The first phase of the plan to be identified for implementation is the Auditing and Financial System (AFS), focusing on the receipt and posting of sales data from mineral extraction. Phase II is the Production Auditing System, and Phase III is the Enhanced Management progam. This report deals with the AFS, Phase I, of a complete Improved Royalty Management Program (IRMP). It describes what the new system is to do, how it will affect the user and the existing organization, and what performance standards it must achieve. The remaining work on the AFS involves designing the system to perform the functions described in this report and implementing that design. Sections presented are: the IRMP; the AFS; Detailed Functional Descriptions; Organizational Requirements; Inputs and Outputs; Performance Requirements; Security and Control Requirements; and Major Conversion Considerations (key considerations for converting from the existing system to the AFS).

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 13426, 14198, 14211, 14349

14175 **(DOE/PE/70278—T10) Assessment of the solar heating and cooling in residential building demonstration program. Interim and final report.** Wolff, D.C. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 21p. NTIS, PC A02/MF A01.

The Solar Heating and Cooling (SHAC) in Residential Building Demonstration of 1974 is assessed. The program's goals and the Government Accounting Office's (GAO) evaluation of the program's success are stated. The program is analyzed with regard to objectives, results, data, and the GAO's conclusions. The differing approaches of the GAO and the Department of Housing and Urban Development (HUD) to the program are analyzed and compared, showing weaknesses in each. Conclusions on the relative success of the program are drawn, and recommendations are made regarding any future programs of this type. (LEW)

14176 **(PB—80-185630) Research, demonstration, training, and fellowship awards, October-March fiscal year 1979.** (Environmental Protection Agency, Washington, DC (USA). Grants Administration Div.). 1979. 292p. NTIS, PC A13/MF A01.

Section I lists research, demonstration, training, and fellowship awards by State, program, and grantee name. Each record provides applicant name, municipality, program element, title, project director, grant identification number, type of grant award, date and dollar amount of award. Section II contains brief project descriptions for research and demonstration projects administered by Headquarters and is arranged in ascending order by the grant identification number. An index is provided for crossreferencing the information between Sections I and II.

14177 **(PB—80-198450) Research, demonstration, training, and fellowship awards: April-September, fiscal year 1978.** (Environmental Protection Agency, Washington, DC (USA). Grants Administration Div.). 1979. 497p. NTIS, PC A21/MF A01.

Section I lists research, documentation, training, and fellowship awards by State, program, and grantee name. Each record provides applicant name, municipality, program element, title, project director, grant identification number, type of grant award, date and dollar amount of award. Section II contains brief project descriptions for research and demonstration projects administered by Headquarters and is arranged in ascending order by the grant identification number. An index is provided for cross-referencing the information between Sections I and II.

2906 Nuclear Energy

14178 **(DOE/ET/40113—T1) Development of new business opportunities for minorities in nuclear energy. Final report.** Spight, C. (AMAF Industries, Inc., Columbia, MD (USA)). 15 Dec 1980. Contract AC01-80ET40113. 164p. NTIS, PC A08/MF A01.

In Part I of this report the basis for the optimal development of new business opportunities for minorities in nuclear energy programs is defined within the successful completion of all contract tasks. The basis presented consists of an identification of a set of qualified minority-owned small businesses, a defined reservoir of highly trained minorities with applicable expertise, a policy context for the development of opportunities, and a proposed networking structure for information transfer/professional development. In Part II a contractor-focused analysis of the structure of the nuclear industry, a breakdown of the DOE nuclear program by region and functional area, and a directory of minority-owned small businesses by region are presented.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 14091, 14293, 14305, 14372, 14373, 14376

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 14110, 14191, 14248, 14249, 14309, 14333

2910 Conservation

REFER ALSO TO CITATION(S) 14229, 14231, 14232, 14233, 14242, 14244, 14259, 14273, 14279, 14310, 14312, 14313, 14314, 14332, 14339

14179 **(NBS-TN—1115) Report on the relevance of the Second Law of Thermodynamics to energy conservation.** Didion, D.; Garvin, D.; Snell, J. (National Bureau of Standards, Washington, DC (USA)). Aug 1980. 54p. NTIS, PC A04/MF A01.

This is a study of the relevance to Federal energy-conservation programs of the use of the concept of energy efficiency as being the ratio of the minimum available work necessary for accomplishing a given task to the available work in the actual fuel used to accomplish this task. Included within the study is a review of selected elements of thermodynamics and efficiency concepts, and identification of the technology pertinent to energy conservation programs. The study examines the potential benefits, if any, that would accrue from the application of Second Law of Thermodynamics principles to these technologies. Results indicate the positive value of the Second Law analytical techniques in the planning and design stages of system development, and the rather limited value of its use during the performance-monitoring stage. Needs for advancing the acceptance and use of the Second Law analytical techniques are identified.

14180 **(PB—80-173198) Capacity-building. Local government approaches to energy conservation.** (Real Estate Research Corp., Chicago, IL (USA). Public Affairs Counseling Div.). Sep 1979. 54p. NTIS PC MF A01.

HUD's Office of Policy Development and Research funded three projects to test a variety of approaches to municipal management of energy conservation. This overview of all three can be useful to other local governments faced with tight resources and bulging energy demands. It outlines the strategies used by 10 California cities, a number of Massachusetts cities, and Portland, Oreg., to develop new energy conservation plans and policies. As a whole, the projects found that better use of existing energy resources helped control rising levels of energy expenditures, reduced uncertainties and dependence caused by heavy use of imported oil, prevented overreliance on developing forms of energy while extending the time available for the efficiency of these sources to be proven, and prevented exhaustion of existing supplies. The California Innovation Group worked through an existing local government network of science advisors to identify appropriate conservation programs. Anaheim, Calif., as the lead city, analyzed energy uses and sources using supply and demand projections to determine problem areas. An urban energy management plan was developed outlining auditing procedures, municipal codes and ordinances, and public utilities and public relations policies directed at conservation. The Massachusetts Department of Community Affairs assisted small and medium-sized cities in establishing conservation plans, worked with six municipalities in drawing up individual plans, and conducted local seminars. This led to the establishment of an ongoing agency, the Energy Extension Service. Portland established a citywide energy policy steering committee and an interdepartmental energy management task force to implement an energy conservation policy that evolved from research based on projections of demand and land use patterns. An index to energy conservation and management methods and documents, by project and subject, is provided.

14181 **(PB—80-177157) Evaluation of CSA Emergency Energy Conservation Services Program; research design: sampling, data collection, data management, data analysis.** (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). 7 Jun 1978. 127p. NTIS, PC A07/MF A01.

This report details the research design and methodology for an evaluation of CSA's Emergency Energy Conservation Program.

14182 **(PB—80-190770) Energy in the cities symposium.** Werth, J.T. (American Planning Association, Chicago, IL (USA). Planning Advisory Service). Apr 1980. 55p. NTIS, PC A04/MF A01.

This report addresses city government frustration in developing conservation plans and energy management strategies caused by inadequacies of staff, finance, and interagency coordination. One paper describes the planning process of the Southern Tier Regional Council in New York State designed for bringing energy problems and policymaking down to the local level. Another calls on the Federal Government to provide incentives for local government action, especially in the form of funds for energy conservation planning, supplied free of institutional barriers and penalties. Another contribution explores the relationship between the rebirth of cities and the journey to work and analyzes the potential implications of these phenomena in terms of higher energy costs. A paper on the high costs of heat views this expense as a new threat to city neighborhoods and calls for neighborhood education and outreach programs to include onsite energy counseling for inhabitants along with energy audits and technical assistance programs, while another presents ideas for advancing conservation features in the building industry using a series of incentives and regulatory policies. The final contribution examines the impact of environmental regulations, taxation, and the cost burdens on potential utility customers in the demise cogenerational systems for supplying energy. This symposium is representative of the range of efforts underway throughout the country to help local communities control their energy futures. Tabular data, illustrations, and footnotes are provided.

14183 **(PB—80-204274) Massachusetts long-range energy conservation plan.** (Massachusetts Energy Office, Boston (USA)). Jan 1978. 16p. NTIS, PC A02/MF A01.

Long range plans dealing with consumer education and protection, state programs, commercial buildings and code reforms, low/middle income and urban programs, rate reforms, carpools/vanpools, alternative energy sources, and waste oil are discussed.

14184 **Energy conservation, efficiency, and substitution.** Bueche, A.M. (General Electric Co., Schenectady, NY). *EPRI (Electric Power Research Institute) Journal ;* **5**: No. 10, 24-29(Dec 1980).

Adapted by Jenny Hopkinson from a speech to EPRI's Advisory Council at its Summer Seminar, Aspen, Colorado, August 13, 1980.

The US has failed to make a serious reduction in oil consumption because, unlike other western countries, the US has not made a national commitment to develop alternative energy sources. Energy costs, as a result, are no longer in equilibrium with the gross national product. A proposal to replace oil with electricity in five end-use applications is possible with present technology and, in most cases, with available products. The suggested end uses are residential and commercial space conditioning, low-temperature industrial and commercial heat, high-temperature industrial direct heat, intracity passenger and freight transport by bus and van, and high-density rail transport. Other opportunities are substituting electricity or coal for gas and repowering oil-fired power plants to burn coal. Low-cost and cost-effective options should be taken first and should concentrate on replacing oil and on the costs of changing the energy systems. (DCK)

2920 Supply, Demand, And Forecasting

14185 **(BNL—28740) Oil/gas supply modeling considerations in long-range forecasting.** Cherniavsky, E.A. (Brookhaven National Lab., Upton, NY (USA)). Dec 1980. Contract AC02-76CH00016. 17p. (CONF-800650—2). NTIS, PC A02/MF A01.

From Symposium on oil and gas supply modeling; Washington, DC, USA (18 Jun 1980).

Oil- and gas-supply modeling may not only generate forecasts on a stand-alone basis, but may provide input data and assumptions to large-scale, long-range integrated energy economy models. In such a framework, parameters that may not have seemed especially crucial in the stand-alone formulation may be found to have an unexpectedly great influence on the results. Additionally, it may become necessary to incorporate considerations that are usually omitted from conventional oil- and gas-supply models; this paper discusses two such examples: the decline rate, or more generally the production profile, and the treatment of resource exhaustion. This investigation arose in connection with a project for the Energy Information Administration (EIA). One part of the project was to incorporate the assumptions and input data of EIA's Midterm Oil and Gas Modeling System (MOGSMS) into EIA's Long-Term Energy-Analysis Program (LEAP). Two important areas for oil- and gas-supply model development and data collection are representation of the decline rate or production schedule from reserves, and the treatment of resource depletion including the subeconomic resource base and enhanced recovery. Both aspects receive relatively little attention in oil- and gas-supply models, but play key roles when the assumptions of these models are integrated into a long-term model such as LEAP.

14186 **(ORAU/IEA—81-2(M)) Global energy consumption and production in 2000.** Allen, E.L.; Davison, C.; Dougher, R.; Edmonds, J.A.; Reilly, J. (Oak Ridge Associated Universities, Inc., TN (USA). Inst. for Energy Analysis). Feb 1981. Contract AC05-76OR00033. 57p. NTIS, PC A04/MF A01.

Detailed energy supply and demand analyses are projected to the year 2000 for the world as a whole, after projections in 4 categories: (1) the Organization for Economic Cooperation and Development (OECD); (2) the centrally planned economies; (3) the Organization of Petroleum Exporting Countries (OPEC); and (4) a group of non-OPEC, free-world developing countries. This study anticipates that global energy demand will continue to expand through 2000, although at a slower pace than in 1965 to 1978. Growth of supply is expected to be largely in conventional, nonrenewable fuels - coal, oil, uranium, and natural gas. Energy growth is also expected to slow down in terms of energy consumption per unit of output as a consequence of continuing efficiency improvements, which, in turn, result from higher energy prices. Slower rates of economic growth are expected in all groups of countries, developed and underdeveloped. But the authors expect the pace of expansion in the OPEC and non-OPEC developing world will be far faster than in the more-advanced nations. The global demand for energy in 2000, roughly 500 exajoules, can be met largely from the increased output of fossil fuels and within the modest price increases postulated in the scenarios. The total non-Communist demand projected in this scenario for 2000 is less than that projected in scenarios prepared a few years ealier by other organizations.

14187 **(ORNL—5744) Contribution to screening methodology.** Perey, F.G. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 49p. NTIS, PC A03/MF A01.

The screening method for determining objective approximate values for the sensitivity coefficients of the output of a computer code to the input data is analyzed. An estimator proposed to solve such problems is used to investigate one of the outputs of a simplified model of the Long-Term Energy Analysis Program (LEAP) of the Energy Information Administration (EIA). The results are presented and compared to the true values of the sensitivity coefficients. The estimator produces results that appear more arbitrary than approximate. The screening problem is analyzed from the point of view of a theory of logical inference, and it is argued that no objective, approximate, and useful solution exists for a code treated as a black box (that is to say, that no assumptions, prior or otherwise, are made about the code, except the ability to run) since no degree of confidence can be placed on the solution. Requirements on additional information needed to produce a solution that could qualify as objective, approximate, and useful are investigated. It is shown that such information can in principle be obtained, and the problem then admits a solution. The emphasis is on the conceptual aspects rather than on the mathematical details of the problem and its solution. 2 figures, 4 tables.

14188 **(PB—80-172869) Urban energy management study. Supplement to final report. Final report summary: implementation.** (California Innovation Group, Inc., San Jose (USA)). Sep 1977. 65p. NTIS, PC A04/MF A01.

This final report, part of a study to determine the possibilities for local government management of energy - related problems, summarizes implementation measures taken in conjunction with the overall study as of September 1, 1977. The report summarizes the end - products of the UEMP, such as (1) a survey and evaluation of municipal energy conservation techniques (street lighting, vehicle fleets, heating and cooling of city buildings) for Anaheim and other CIG members; (2) a study of energy supply and demand patterns in the community of Anaheim; and (3) preparation of an energy management plan for Anaheim, including an evaluation of different conservation and supply techniques. In addition, three energy management workshops for local government were held in California, with over 40 local officials sharing their experiences on street lighting, pool covers, vehicle fleets, and other topics. Currently, the city has two large scale, energy - related programs: (1) Anaheim's electric utility is participating in the design and implementation of the Intermountain Power Project, and (2) all city departments are developing long - term plans for the conservation of energy in their operations. Other energy - conserving activities are described for Anaheim and other CIG cities, including Huntington Beach and Garden Grove, Pasadena, San Diego, San Jose, Burbank, Santa Clara, and Fresno. Non-CIG cities are also beginning to model their energy programs after the Anaheim UEMP, such as Torrence, Calif., which recently created an energy conservation citizen task force to suggest energy conservation measures. The UEMP demonstrates that local agencies can take a strong role in community energy management.

14189 **(PB—80-192503) Capital impacts of energy and energy-related development in Appalachia.** (CONSAD Research Corp., Pittsburgh, PA (USA)). Oct 1978. Contract ARC-TQ-6/CO-5215. 504p. NTIS, PC A22/MF A01.

The report contains two principal elements. The first element examines the direct, indirect and induced capital needs for the Appalachian Region over the period 1976-1985. The purpose of this analysis is to determine the general (multi-county) location of future capital needs and compare such needs with forecasts of public revenue capacity. In essence, this element indicates which portions of the Region are most likely to be negatively affected by future energy development as a result of their being unable to finance the public and private infrastructure necessary to accommodate growth. The second element of the report examines two actual cases of energy development in Appalachia. Using the case study approach, the increased demand for public and private services and the resulting capital requirements were investigated. The contractor has also forecast such needs and requirements through the 1985 time horizon.

14190 **Regional economic modeling for energy forecasting.** Knox, H.W.; Sandoval, A.D. pp 239-253 of Modeling the multiregional economic system: perspectives for the eighties. Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

This chapter reports on ongoing research within the Energy Information Administration to develop a regional economic forecasting capability to use in conjunction with an already-existing regional-energy-forecasting system. Regional economic models have served two main functions at EIA. They have been used to provide projections of economic variables for use as inputs in regional energy-demand forecasting models, and they have been used to help determine regional economic impacts given output from energy and national economic models. A schematic comparison of the existing approach and the approach under development is shown. A comparison of preliminary results showing differences in regional energy supply and demand projections resulting from the choice of regional economic forecasting systems is also presented. The current system utilizes a top-down (TD) modeling approach (DRI/MACRO/REGSHARE) to derive estimates of income, population, and value added at the Federal energy region level. These estimates then drive regional energy-demand systems (RDFOR/SEED) which in turn provide inputs into an integrating model (MEMM). The integrating system utilizes regionally specific energy-supply curves and a programming framework to satisfy the regional energy demands at minimum cost. The system under development utilizes the national-regional impact evaluation system (NRIES) in place of the DRI/MACRO and REGSHARE models.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 13349, 13394, 13821, 13826, 14112, 14149, 14152, 14160, 14161, 14180, 14231, 14232, 14233, 14234, 14235, 14236, 14242, 14312, 14313, 14314, 14720

14191 **(ANL/EES-TM—125) Guidelines to assist rural electric cooperatives to fulfill the requirements of Sections 201 and 210 of PURPA for cogeneration and small power production.** (National Rural Electric Cooperative Association, Washington, DC (USA)). Feb 1981. Contract W-31-109-ENG-38. 189p. NTIS, PC A09/MF A01.

These guidelines were designed to assist National Rural Electric Cooperative Association staff and consultants involved in the implementation of Sections 201 and 210 of the Public Utilities Regulatory Policies Act (PURPA). The guidelines were structured to meet anticipated use as: a self-contained legal, technical and economic reference manual helpful in dealing with small power producers and cogenerators; a roadmap through some of the less obvious obstacles encountered by utilities interacting with small power producers and cogenerators; a starting point for those utilities who have not yet formulated specific policies and procedures, nor developed rates for purchasing power from small power producers and cogenerators; a discussion vehicle to highlight key issues and increase understanding in workshop presentations to rural electric cooperatives; and an evolutionary tool which can be updated to reflect changes in the law as they occur. The chapters in these Guidelines contain both summary information, such as compliance checklists, and detailed information, such as cost rate calculations, on regulatory requirements, operational considerations, and rate considerations. The appendices contain more specific material, e.g. rural electric cooperative sample policy statements. (LCL)

14192 **(DOE/PE/70278—T12) Efficient regulation and accounting methods.** Hanson, D.A. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 20p. NTIS, PC A02/MF A01.

The financial performance of a utility depends in part on the quality of its regulatory commission. The discretion given to commissions allows them to adjust to local needs, but it also can lead to poor regulatory decisions. Aside from rate design, problems that commissioners must deal with include the treatment of tax savings from accelerated depreciation and the investment tax credit, the allowed return on common equity, and the regulatory lag period. Each of these issues is described in turn. (RWR)

14193 **(PB—80-174543) Contributions of policy analysis to science and technology policy. Report for 1976-1977.** Logsdon, J.M.; Van der Heuvel, C. (George Washington Univ., Washington, DC (USA). Graduate Program in Science, Technology and Public Policy). Jul 1978. 121p. NTIS, PC A06/MF A01.

During the period April 1974-September 1978, the George Washington University's Graduate Program in Science, Technology, and Public Policy carried out a variety of activities in support of NSF's University Policy Studies (UPS) Program and held a series of seminars for the Washington science policy community. The report is the proceedings for the 1976-1977 seminars. Topics included: (1) Our Energy Future: planning energy research; (2) Science and Technology Policy: an assessment of future problem areas; and (3) Improving the Utility of Federally-supported Policy Research: a funder's perspective.

14194 **(PB—80-181746) Local implementation of emergency energy assistance: an analysis of the 1977 and 1978 programs. Working paper.** Huneycutt, M.J.S.; Koenig, R. Jr.; Chadwin, M.L.; Castro, E.E. (Urban Inst., Washington, DC (USA)). Jan 1980. 228p. NTIS, PC A11/MF A01.

Due to concern about the effects of severe winter weather and rising fuel prices, Congress appropriated $200 million in both 1977 and 1978 for programs of assistance to low income households with high energy bills. This report analyzes local implementation of the Special Crisis Intervention Program of 1977 (SCIP) and the Emergency Energy Assistance Program of 1978 (EEAP).

2940 Fossil Fuels

14195 **(DOE/PE/70278—T4) Vulnerability reduction study. Coal and synthetics (Section III a). Technical Appendix.** (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 29p. NTIS, PC A03/MF A01.

This Appendix supports and explains key statements made in the chapter on Coal and Synthetics. The reader will find information and documentation on points that lend themselves to quantification. Evidence is presented that coal supply will not be constrained by production or transportation factors through the 1980s. Any program to increase the direct use of coal in the industrial sector must take into account a number of identifiable difficulties. A deployment schedule for 10 oil shale projects has been developed by the Office of Technology Assessment. This schedule, if adhered to, would result in an initial deployment of an oil shale industry of 400,000 bpd oil equivalent by 1990. In addition, the Appendix provides descriptions of those major elements of Federal legislation that bear directly on coal, notably portions of the Powerplant and Industrial Fuel Use Act of 1978, the Energy Tax Act of 1978, the Energy Security Act of 1980, and the Clean Air Act.

14196 **(DOE/PE/70278—T6) World oil price behavior during oil supply disruptions: what can we learn from the past.** Birdsall, T.H. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). Aug 1980. Contract AC01-80PE70278. 30p. NTIS, PC A03/MF A01.

The purpose of this paper is to: (1) examine how world oil prices have behaved during past oil supply disruptions, (2) attempt to understand why world oil prices have behaved during disruptions as they have, and (3) see what history foretells, if anything, for the behavior of world oil prices during future oil supply disruptions.

14197 **(EPRI-EA—1273(Vol.1)) Coal mining cost model. Volume 1. Underground coal mining cost model. Final report.** Toth, G.W. (NUS Corp., Rockville, MD (USA)). Jan 1981. 305p. NTIS, PC A14/MF A01.

The revised EPRI coal mining cost models represent a computerized approach to the analysis of production costs and mining requirements of either surface or underground mining projects. The models estimate all capital and operating costs typically associated with the preproduction and production phases of a coal mining project, and may be applied either to existing mines or to proposed mine openings. The models are an updated and computerized version of the original EPRI Coal Mining Cost Models (EA-437, Vols. 1 and 2). Data bases have been expanded and now reflect a mid-1980 base year for cost items. The process engineering costing procedure has been improved and an entirely new financial analysis procedure has been developed offering many new financial options. The models have been designed for use by a variety of technical disciplines ranging from resource planners to mining practicioners. The input parameters have been structured to reflect varying degrees of familiarity with mining and cost analysis procedures. Three levels of input parameters are used in the cost models: required, default, and override categories. The required category identifies the minimum information required to initiate a model run including basic information describing the physical, operating, and financial aspects of the project. The default category includes more detail or technical parameters which are assigned default values by the model. The override category lists those costs and other values calculated by the model, which may also be input by a model user when detail project information is available. The models have been designed for use in either a batch or interactive processing mode and are documented in four volumes: Volume 1 is the Underground Coal Mining Cost Model.

14198 **(PB—80-169469) Coordinating fossil fuel research in natural gas recovery, coal.** (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Energy Inst.). 1979. 29p. NTIS, PC A03/MF A01.

This report reviews projects that range from studying the State's fossil fuel resources to developing new methods for expanded exploration, improving production techniques, and developing programs which best utilize these resources.

14199 **(PB—80-170327) The future regional distribution of national synthetic fuel capacity. Final report.** Schanz, J.J. Jr.; Sawyer, J.W. Jr.; Perry, H. (Resources for the Future, Inc., Washington, DC (USA)). Jun 1979. 122p. NTIS, PC A06/MF A01.

The purpose of this study is to examine the factors which have and will continue to influence plans for the eventual locations of future facilities to produce synthetic liquid and gaseous hydrocarbons from either coal or oil shale. The objective is to refine the analyses of where these plants are most likely to be placed regionally. The first section of this report examines previous case studies followed by an analysis of technological constraints on power plant location. The locational decision-making process is looked at from the basis of four anticipated types of energy producing facilities -- oil producing companies, interstate pipeline transmission companies, regional gas distributors, and energy consulting companies. The final section addresses two potential issues of the findings--forecasting and modelling of regional energy development, and policy-based decision-making.

14200 **(PB—80-174352) Crude oil energy requirements: from exploration to refinery. Technical report.** Woo, M.T. (Chicago Univ., IL (USA). Resource Analysis Group). Mar 1978. 50p. NTIS, PC A03/MF A01.

The process-type net energy analyses described in this study examines five methods of crude oil production: primary production and water injection production in West Texas; offshore production in the Gulf of Mexico and North Sea; and onshore production in the Middle East. The use of engineering and disaggregated data allows requirements to be traced at an individual input level. Overall results are divided into production: exploration to field termination, and transportation: field termination to refinery. These microstudies are technology - and situation- specific rather than industry-specific and therefore should be thought of as typical examples of industry practice rather than averaged results of industry practice. The findings indicate that the total energy used for petroleum extraction is high enough that improvements in its efficiency of use could help to generate a significant reduction in U.S. petroleum demand.

14201 **(PNL-SA—8641) Potential barriers to increased production of natural gas from unconventional sources.** Riedel, E.F.; Rotariu, G.A.; Goldberg, A.J. (Battelle Pacific Northwest Labs., Richland, WA (USA); Office of Technology Assessment (U.S. Congress), Washington, DC; Department of Energy, Washington, DC (USA). Office of Technology Impacts). Jun 1980. Contract AC06-76RL01830. 14p. (CONF-800610—11). NTIS, PC A02/MF A01.

From American Institute of Chemical Engineering conference; Philadelphia, PA, USA (8 Jun 1980).

For Western Sands, Eastern Shales and Coalbed Methane, application of environmental controls currently in use in gas field production should result in environmental effects being localized and temporary. Environmental concerns do not appear to represent significant barriers to commercial production of gas from these resources. The principal barrier to commercial production of gas from Western Gas Sands remains one of gas price. The barrier appears to be disappearing. Lack of adequate geological information for use in selecting potential drill sites appears to be the principal barrier to production of gas from Eastern Shales. The legal question of gas ownership and the conflicting interests of coal and gas producers seems to be the principal hurdle that must be overcome before significant quantities of Methane from Coalbeds will be utilized commercially. For Geopressured Aquifers, the environmental barriers of subsidence and disposal of produced brine water appear to be major constraints. These are expected to preclude significant production of gas from this resource in the near future. The re-

source with the largest near-term capability for commercialization appears to be Western Gas Sands. This resource is estimated to yield 1 to 2 Tcf/year by 1982. It is more difficult to estimate the probable contribution from the next two most likely resources; Methane from Coal and Eastern Gas Shales. These resources might be capable of yielding from .01 to 1 Tcf/year by the mid-1980's. Current engineering evidence seems to indicate that no significant quantities of gas will be produced from geopressured aquifers in the foreseeable future. Information from current tests now underway in Texas and Louisiana should permit better evaluation of the long-term viability of this resource.

14202 **Role of coal in America's energy future.** Sawhill, J.C. (Dept. of Energy, Washington, DC). pp 9p, Set No. 1, Paper 3 of Session papers presented at the 1980 American Mining Congress international coal show. Washington, DC; American Mining Congress (1980).

From American Mining Congress international coal show; Chicago, IL, USA (5 May 1980).

The US DOE program consists of five parts: (1) a $10 billion, ten-year program to reduce utility oil and gas consumption by the equivalent of one million barrels of oil daily, replacing them with coal and other fuels; (2) an acceleration of coal leasing on Federal lands; (3) a program to increase coal exports to the 80 million ton level by the end of the decade; (4) $20 billion for the first phase of a program designed to create a synthetic fuels industry, which could be producing as much as two million barrels of liquid and gaseous fuels per day by 1990; and (5) rapidly growing investment in coal R and D, which will top one billion dollars in 1981. DOE already has authority to prohibit industry and utilities from burning oil or natural gas in boilers with an alternate fuel capability. Orders have been issued for conversions that could stop the burning of 175,000 barrels of oil per day. Financial and institutional factors have made it difficult for the utilities to convert to coal. Confronted by poor earnings, tight capital markets and high interest rates, they simply do not have the resources to pay for the capital costs of conversion, and their State Regulatory Commissions have been reluctant to give them the necessary rate relief. Something had to be done to remove these barriers. A major piece of legislation, which was recently sent to Congress, is designed to make it easier for utilities to convert to coal.The objective is the displacement of a million barrels of oil equivalent by 1990. The bill mandates the conversion of 107 coal-capable plants at 50 generating stations, but it goes beyond merely converting coal-capable powerplants. It will provide incentives for early retirement of non-coal capable plants and expedite their replacement with coal-fired installations.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 13569, 13571, 14206

14203 **(DOE/RA/00001—T5(Vol.1)) Synfuel program analysis. Volume I. Procedures-capabilities.** Muddiman, J.B.; Whelan, J.W. (Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA)). Jul 1980. Contract AC09-76SR00001. 119p. NTIS, PC A06/MF A01.

This is the first of the two volumes describing the analytic procedures and resulting capabilities developed by Resource Applications (RA) for examining the economic viability, public costs, and national benefits of alternative synfuel projects and integrated programs. This volume is intended for Department of Energy (DOE) and Synthetic Fuel Corporation (SFC) program management personnel and includes a general description of the costing, venture, and portfolio models with enough detail for the reader to be able to specifiy cases and interpret outputs. It also contains an explicit description (with examples) of the types of results which can be obtained when applied to: the analysis of individual projects; the analysis of input uncertainty, i.e., risk; and the analysis of portfolios of such projects, including varying technology mixes and buildup schedules. In all cases, the objective is to obtain, on the one hand, comparative measures of private investment requirements and expected returns (under differing public policies) as they affect the private decision to proceed, and, on the other, public costs and national benefits as they affect public decisions to participate (in what form, in what areas, and to what extent).

2960 Electric Power

14204 **(NP—25280) Electric Utility Rate Design Study: economic theory of marginal-cost pricing and its application by electric utilities in France and Great Britain.** Westfield, F.M. (Vanderbilt Univ., Nashville, TN (USA)). 12 Aug 1980. 94p. EPRI, Palo Alto, CA.

This report (1) reviews economic theory of marginal-cost pricing; and (2) examines its applications, going back to the 1960s and before, by electric utilities in France and Great Britain. An ideal pricing system for an economy is first reviewed to clarify fairly complicated ideas of economic theory for noneconomists - the industry specialist and state regulator. The concept of ideal marginal-cost pricing as applied to electricity is then developed. Next, an overview is provided of practical issues that need to be faced when the theory is implemented. Finally, the study turns to examine how the theory has actually been interpreted and applied to electricity rate design by the French and the British. Their methods of transforming theory into practice are reviewed, illustrative tariffs that incorporate their interpretation are provided.

14205 **(NP—25287) Electric Utility Rate Design Study: comments on An Evaluation of Four Marginal-Costing Methodologies.** (Temple, Barker and Sloane, Inc., Lexington, MA (USA)). 12 Jun 1980. 185p. EPRI, Palo Alto, CA.

This report is an extension of NP-24255 (EAPA 6:1820), An Evaluation of Four Marginal Costing Methodologies (RDS No. 66), which summarizes, contrasts, and evaluates four marginal costing methodologies currently in use by various electric utilities. The proponents of the four methodologies evaluated by Temple, Barker, and Sloane (TBS) were asked to comment on the TBS report (RDS No. 66). Other selected reviewers were asked to comment on the TBS report. This report, RDS No. 67, is an anthology of all those comments plus a response to them by TBS. The rebuttal comments from TBS appear first, followed by comments submitted by Ralph Turvey, an authority in microeconomics. The next comments are to the Rate Design Study by members of Advisory Group I, experts in the field of electricity pricing. The next four sections present detailed comments submitted by the four marginal-cost proponents: Cicchetti, Gillen, and Smolensky; Ernst and Ernst; Gordian Associates; and National Economic Research Associates.

14206 **(P—300-80-039) Status of proposed energy projects.** Allen, E. (California Energy Commission, Sacramento (USA)). 1981. 91p. California Energy Commission, Sacramento, CA.

Information on the energy projects planned by investor-owned electric utilities, municipal utilities, local irrigation districts, and the State Department of Water Resources in California is presented. Synthetic-fuel projects planned by Pacific Gas and Electric and Southern California Edison are also covered. Projects are discussed in chronological order in individual utility sections, with details on the location, fuel type, electric capacity, and project status. Currently, resource additions of approximately 23,195 megawatts are planned, with approximately 7328 megawatts under construction.

14207 **(PB—80-169006) The Tennessee Valley Authority: a field study. Final report.** Knop, H. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). 1979. 243p. NTIS PC E08/MF E08.

The present report covers four major aspects of the TVA program: the systems approach to regional industrial development programs; the managerial structure of the TVA, including specific management case studies of several key departments; the application of models and computer techniques to management; and the integration of environmental factors into the TVA management and planning process, including a case study dealing with the environmental decision-making process in the siting of a nuclear power plant. (Copyright (c) 1979 IIASA.)

14208 **(PB—80-192180) Costs and benefits of power pooling in California. Consultant report (final).** Badertscher, N.; Khan, S.; Markel, L.; Curtice, D.; Lee, S. (Systems Control, Inc., Palo Alto, CA (USA)). May 1980. 195p. NTIS, PC A09/MF A01.

The study was performed to determine if increased power pooling among California's four largest utilities would reduce costs and improve reliability. Benefits examined included reduced production costs, fuel oil savings, sharing emergency generation, and reduced need for new power plants. Pooling costs examined were for new control centers and transmission lines.

14209 **(PB—80-203177) Use of a future test year for electric utility ratemaking. Final report.** Miller, R.E. (Wilson (J.W.) and Associates, Inc., Washington, DC (USA)). Nov 1979. Contract NBS-5-35894. 139p. NTIS, PC A07/MF A01.

This report is one of a series involving work by the Experimental Technology Incentives Program (ETIP) designed to accelerate or otherwise improve decisions in electric utility rate cases in state regulatory commissions. The objective is to provide incentives for technological innovation. The future test year method projects an electric utility's cost forward into the first full year when proposed new rates will be in effect so that rates can be matched to costs. The report explains how all the elements of a test year cost of services may be projected into the future.

14210 **(PB—80-209794) The CTARP energy facility siting study. Volume I. Coastal facility siting and the national interest.** McAlister, J.T. Jr.; Roughgarden, J.D. (Stanford Univ., CA (USA). Center for Technology Assessment and Resource Policy). Apr 1979. 180p. NTIS, PC A09/MF A01.

The first of four volumes of a study dealing with energy facility siting in the coastal zone and the national interest presents a conceptual summary and policy analysis. The problems and common structure of energy facility siting controversies are reviewed and the current role of coastal management is commented on briefly. The meaning of interest statements and related concepts is discussed and a presentation and comparison of two opposing views of the national interest are presented. The institutional mechanisms needed to initiate the sample process are described. The nature of the process dealing with procedural decisions, cooperative analysis, and bargaining is discussed.

14211 **Research progress review.** *EPRI (Electric Power Research Institute) Journal ;* **6**: No. 1, 1-40(Jan 1981).

EPRI now sponsors some 1200 research projects on behalf of its member utilities. The work is far-ranging but shares the common purpose of providing information and technology to meet the needs of existing systems and to develop advanced alternatives that will allow the expansion of those systems. At the insistence of its sponsoring organizations, an increasing percentage of the work is now devoted to near-term R and D, that is, to hardware and systems that can be delivered within the next decade. As a result of this pressing mandate to deliver and the breadth of activity, information and technology are now beginning to flow from EPRI contractors at an accelerating rate. But this proliferation presents new problems - notably, how to integrate, assimilate, and transfer the results to the utility systems. EPRI President Floyd Culler leads off this year's review issue of the EPRI Journal by addressing this emerging problem of technology transfer. The tools, he points out, are the traditional ones of people and paper, and these in today's climate of rapid change may not be fast enough or even sufficient. More-rapid and less-diffuse approaches are being explored. Familiarity and exposure are the first steps in technology transfer, and this issue is devoted to an overview of some four dozen representative projects and to a distillation of the Institute's five-year plan. The hope is to inform the reader about EPRI's R and D strategy, program plans, and some of the key research results that will be forthcoming in the 1980's.

14212 **Descriptive documentation for New Mexico Electric Power Generation Model.** Santa Fe, NM; EMIS-Resource and Development Division (1981). 102p. (NP—25247).

The New Mexico Electric Power Generation Model was developed to help state policymakers determine the effects of stringent air emission and water discharge restrictions and limited capital and fuel availability on: (1) the configuration of the state power production complex; (2) costs of electricity generation; and (3) fuel mixes. The model can reflect the least-cost technological generation mix, fuel mix, and waste treatment configuration for any specified base year for the State of New Mexico. Information is included on the design and development of the programming model, the data requirements and sources, uses, and simulation capabilities. (LCL)

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 14282

14213 **(DOE/PE/70278—T2) Conservation trend indicators. Interim and final report.** Peterson, C. (Harvard Univ., Cambridge, MA (USA). Energy and Environmental Policy Center). 21 Aug 1980. Contract AC01-80PE70278. 80p. NTIS, PC A05/MF A01.

This report outlines major conservation trends for the four US energy consuming sectors: residential, commercial, industrial, and transportation. Tables on residential use include data on gas, electricity, and fuel oil. Data is not available for renewable sources or for bottled gas, kerosene, or propane. Commercial data is also reported for gas, electricity, and fuel oil, and total consumption is examined on a square foot basis. Industrial trends are shown for the ten most energy intensive industries. In addition, industrial efficiencies by fuel are analyzed. For the transportation sector, petroleum products (particularly gasoline) are the major fuels considered, and selected energy intensities are examined. The discussion on each sector will cover findings, data sources, and data interpretation. Recommendations on reporting are part of the residential section of this report.

14214 **Comprehensive regional energy data base.** Hill, J.; Lewis, N. pp 49-55 of Modeling the multiregional economic system: perspectives for the eighties. Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

A summary is presented of the steps taken to create a comprehensive disaggregated US regional energy data base. This data base contains annual price and quantity data for the period 1960 to 1977, by state, fuel type, and consumer type. The energy data base was created by making use of information contained in two sources: the Annual Survey/Concensus of Manufacturers and the Federal Energy Data System. Some differences and similarities are examined. In constructing the data base an attempt was made to use the strong points of each of these data bases. Data for residential, commercial, and transportation uses come directly from FEDS, but data for industrial uses result from utilizing information in both FEDS and ASM. Because of the greater coverage of ASM in census years, that source is felt to be most reliable and was therefore used as benchmarks. However, for intercensal years, FEDS data on total industrial use by state and by fuel type were used in conjunction with ASM two-digit SIC data on total fuel consumption by state.

2990 Unconventional Sources And Power Generation

14215 **(SERI/SP—751-877) Guide to commercial-scale ethanol production and financing.** (Solar Energy Research Inst., Golden, CO (USA)). Nov 1980. Contract AC02-77CH00178. 315p. NTIS, PC A14/MF A01.

This document is designed to lead the potential investor through all the steps necessary to develop a business plan and prepare a feasibility analysis for a site-specific project. Emphasis is placed on marketing, financing, management, and incentives rather than primarily technical matters. The introduction provides an overview of the perspectives and issues in the alcohol fuels industry. Chapter II seeks to surface factors which affect the decision-making process. The chapter attempts to lead the investor step-by-step through the series of decisions and choices to be made before reaching the final decision to enter the business. Chapter III describes the types of feedstocks available and relates them to areas within the United States. Trends and fluctuations in the price of the major grain feedstocks are also discussed in terms of their potential use and value compared to other feeds. Chapter IV discusses the market potential of ethanol and its coproducts, and examines how

the location of the ethanol markets in relation to those of the feedstock supplies may influence selection of a plant site. Various aspects of plant design are discussed. A 50 million gallon per year plant is analyzed to provide the general technical background and costing data required in analyzing plants of various sizes and designs. Safety aspects and environmental concerns are treated in Chapters VI and VII. The regulations are reviewed and their impact on plant design and operation is discussed. The basic elements of a business plan are described which lead to an approach for development of the feasibility study. Other information on financial assistance, regulations, current legislation, and reference material is given in the Appendices.

14216 **Energy from biomass.** *EPRI (Electric Power Research Institute) Journal ;* **5**: No. 10, 30-32(Dec 1980).

Title II of the Energy Security Act of 1980 authorizes DOE to finance projects on energy from biomass, municipal wastes, and alcohol fuels. This month's Washington Report from EPRI looks at DOE's near-term programs in wood, agricultural waste, municipal solid waste, and alcohol fuels; a future report will examine long-term programs. Wood is the most promising of the near-term programs, and is used for direct burning as well as for gasification. Forest damage is expected to be minimized as increased demand forces better forest management. Liquid fuels are produced by distilling grain into ethanol. DOE spokesmen expect increased efficiency to resolve the conflict of food versus fuel production. The use of municipal wastes as an energy source has the added attraction of solving environmental problems. Concentrating on higher yields per acre and improved conversion techniques, DOE expects biomass to be the major solar contributor by 2000. (DCK)

14217 **(PB—80-168735) Solar options in central Europe. A synthesis of solar technology assessment and contemporary criteria in 1978-1979.** Bell, C.R. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 30p. NTIS PC E03/MF E03.

This report identifies the options that are now most viable for solar energy exploitation in central Europe, and the economic as well as technical parameters of these options.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

14218 **(PB—80-810856) Magnetohydrodynamic generators in power generation. 1964-May 1980 (citations from the NTIS data base). Report for 1964-May 1980.** Reed, W.E. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 279p. NTIS PC N01/MF N01.

The citations include research on performance, costs, efficiency, and design of MHD generators and their use in fusion and fission reactors, and fossil fueled plants. (This updated bibliography contains 272 abstracts, 40 of which are new entries to the previous edition.)

14219 **Nucleation and evolution of slag droplets in coal combustion.** Im, K.H.; Chung, P.M. (Argonne Natl Lab, Ill). *AIChE (American Institute of Chemical Engineers) Journal ;* **26**: No. 4, 655-663(Jul 1980).

Kinetics governing the nucleation and size variation of the slag droplets are first analyzed. Governing conservation equations are then formulated for the droplets and the surrounding gas-vapor mixture. These equations are solved numerically for the environments representing a typical flow through the channel and diffuser of a coal fired, MHD, power generation system, The average droplet size, total number density and the droplet size distribution are found to be rather strongly influenced by the total slag mass fraction and the supersaturation ratio. 17 refs.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 13547

14220 **(SERI/TP—641-849) Analysis of the application of thermogalvanic cells to the conversion of low grade heat to electricity.** Chum, H.L.; Fahlsing, R.F.; Jayadev, T.S. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1980. Contract AC02-77CH00178. 8p. (CONF-800806—41). NTIS, PC A02/MF A01.

From 15. intersociety energy conversion engineering conference; Seattle, WA, USA (18 Aug 1980).

Aqueous thermogalvanic cells, the solution analogs of solid-state thermoelectric devices, are compared for power generation. Measurements on the copper/copper formate/copper system yield thermoelectric powers, $(\Delta E/\Delta T)/sub\ I=O/$, of 1.25 - 1.9 mV/degree, which are higher than those exhibited by other copper systems. In these solutions three copper formate complexes are present. Practical cells were built and tested. The power output is largely limited by cell resistance, though mass and charge transfer contribute to the observed overvoltages. The coupling of this thermogalvanic system with an electrochemical photovoltaic effect (a photothermogalvanic cell) is briefly described.

3004 Thermionic Converters

14221 **(PB—80-810906) Thermionic energy conversion. June 1977-May 1980 (citations from the NTIS data base). Report for June 1977-May 1980.** Reed, W.E. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 136p. NTIS PC N01/MF N01.

Research on thermionic power generation, power plant design, converter design, and basic research on thermionic materials are cited in the bibliography. Spacecraft applications are included. (This updated bibliography contains 129 abstracts, 23 of which are new entries to the previous edition.)

3005 Fuel Cells

14222 **(AD-A—0898445) Electrolytes for hydrocarbon air fuel cells. Interim technical report.** Walsh, M.; Walsh, F.; Crouse, D.N.; Morris, R.S. (ECO, Inc., Cambridge, MA (USA)). Apr 1980. 33p. NTIS, PC A03/MF A01.

The present research is directed towards obtaining an improved electrolyte for hydrocarbon-air fuel cells. No commercially available electrolyte appears to demonstrate promise. Two new electrolytes, difluoromethanediphosphonic acid and difluoromethanedisulfonic acid, have been synthesized and are being tested. The present status of the project and the outstanding problems are reviewed.

14223 **(AD-A—0901439) Phosphoric acid fuel cell development. Final technical report, September 1977-November 1979.** Kaufman, A.; Terry, P.L. (Engelhard Minerals and Chemicals Corp., Edison, NJ (USA). Engelhard Industries Div.). Sep 1980. 103p. NTIS, PC A06/MF A01.

Phosphoric acid fuel cells and fuel cell stacks were evaluated operating on simulated product gases from a methanol reformer. Three-cell stack performance in a start-up/shut-down cycling mode was investigated. Improved matrix and electrode formulations were utilized later in the program, and these components accumulated a total of 8496 hours of testing and 268 shut-down cycles. (Author)

14224 **(BNL—51272) Fuel cell applied research: electrocatalysis and materials. Quarterly report, October 1-December 31, 1979.** Srinivasan, S.; Isaacs, H.S.; McBreen, J.; O'Grady, W.E.; Olender, H.; Olmer, L.J.; Schouler, E.J.L.; Kordesch, K.V. (Brookhaven National Lab., Upton, NY (USA)). May 1980. Contract AC02-76CH00016. 60p. NTIS, PC A04/MF A01.

Research on electrocatalysis of phosphoric acid fuel cell reactions is reported. Five types of carbon obtained from Cabot Laboratories (Cabot designation of carbons - Monarch 1300, CSX 98, Mogul L, Vulcan XC-72R and Regan 660R) were compared as

supports for platinum electrocatalysts. Experiments were conducted to determine the wetting characteristics of the carbons on the electrocatalytic activity of supported platinum for oxygen reduction. The latter was investigated by a cyclic voltammetry technique. The changes in the electrochemically active surface areas on increasing the temperature from 25° to 135°C and after carrying out oxygen reduction were measured from the hydrogen desorption charge in the cyclic voltammograms. Also, research on electrode kinetics in high-temperature solid electrolyte fuel cells is described. The influence of electrode material on oxygen reduction kinetics and the reaction mechanism on platinum at interfaces with solid electrolytes were investigated. Direct current and alternating current impedance techniques were used. Studies on the oxidation of H_2 on platinum and gold interfaces with the zirconia electrolyte interface were begun. Experiments on single contact ball electrodes of platinum were used. Slow potential sweep techniques (scan rate 5 mV/sec) were used. Results are presented and discussed. (WHK)

14225 **(DOE/NASA/0176—80/4) Preparation and evaluation of advanced electrocatalysts for phosphoric acid fuel cells. 4th quarterly report, October-December 1980.** Stonehart, P.; Baris, J.; Hochmuth, J.; Pagliaro, P. (Stonehart Associates, Inc., Madison, CT (USA)). 1980. Contract AI01-80ET17088. 36p. (NASA-CR—165245). NTIS, PC A03/MF A01.

Alloy electrocatalysts on carbon supports have been developed for hydrogen oxidation in the presence of carbon monoxide. These electrocatalysts match the best platinum on carbon catalysts for performance yet cost half as much. The results shown demonstrate that a significant reduction in anode electrocatalyst material cost can be achieved by replacing the platinum. Since surface characterization of this catalyst is important to explain its performance, several approaches and pitfalls to the elucidation of the surface characterization are presented.

14226 **(EPRI-EM—1670) Fuel cell power plant integrated systems evaluation. Final report.** Bonds, T.L.; Dawes, M.H.; Schnacke, A.W.; Spradlin, L.W. (General Electric Co., Schenectady, NY (USA). Energy Systems Programs Dept.). Jan 1981. 261p. NTIS, PC A12/MF A01.

Carbonate fuel cell power plants are attractive candidates for future power generation applications. One application of these plants would be central stations (675 MW) fueled by coal. Another would be small dispersed generation plants (5 MW) fueled by oil, probably with reject heat utilization. The activities conducted to define power plant configurations for these two applications are reported. Plant capital costs and cost of electricity were evaluated for both plants. Performance sensitivity studies have led to an improvement in plant cycle efficiency and have considered the important design constraints. Parametric variations and the impact on the plant and components are discussed. Alternate oil-fired cycles as well as several alternate coal gasifiers are examined to show effects on plant performance. A steam injection and anode recirculation study was also performed. A cost sensitivity evaluation was performed for both plants for variations in design parameters and/or design assumptions on the cost of electricity. Through this work, the economic attractiveness of the coal-fired plant is confirmed, and a scenario in which the dispersed oil-fired plant with reject heat recovery is established. Performance for the coal-fired plant (6669 Btu/kWh) exceeds the study goal (6800 Btu/kWh) significantly, and the oil-fired plant performance (7627 Btu/kWh) is very close to the study goal (7500 Btu/kWh). The development of a finite slice computer model of the carbonate fuel cell is reported and an initial parametric cell and plant performance study was performed using the model. Preliminary subsystem description sheets and plant layout arrangements are presented.

14227 **(EPRI-EM—1701) Development of the adiabatic reformer to process No. 2 fuel oil and coal-derived liquid fuels.** Houghtby, W.E.; Buswell, R.F.; Bett, J.A.S.; Lesieur, R.R.; Meyer, A.P.; Preston, J.L.; Setzer, H.J. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Feb 1981. 82p. NTIS, PC A05/MF A01.

Fuel cell power plants may be required to use coal derived liquids or heavy petroleum distillates as fuels. The objective of this program is to develop the adiabatic reformer to process the heavier fuels. Testing was conducted primarily in a 2 inch diameter, bench scale reactor. First, the configuration of the nozzle in which fuel, steam and air were mixed before entering the catalyst bed was optimized. Next, holding the nozzle geometry constant the effect of variation of the catalyst was studied. A bench scale reactor incorporating the optimized nozzle and improved catalysts ran stably for 450 hours. The performance met the goals for a 4.8 MW phosphoric acid fuel cell power plant at a 9300 Btu/kWh heat rate for all conditions except operating pressure which was 45 psia. Two pilot scale, 6-inch diameter adibatic reformers were built, each with a fuel-air mixing nozzle scaled-up from the best configuration identified in the bench scale reactors. The performance of the bench and pilot scale reactors (both filled with commercial nickel catalyst) agreed within a nominal scatter which defined the ability to scale-up the design. Brief tests in the optimized bench scale reactor gave an assessment of the capability of the adiabatic reformer to process coal-derived liquid fuels. Systems studies evaluated the performance of alternate fuel processors, the hybrid, cyclic and thermal steam reformers relative to the performance of the optimized adiabatic reformer. Results are presented and discussed. (WHK)

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 14181, 14184, 14214

14228 **Framework of the multiregional multiindustry forecasting model.** Harris, C.C. Jr., Nadji, M. pp 167-176 of Modeling the multiregional economic system: perspectives for the eighties. Adams, F.G.; Glickman, N.J. (eds.). Lexington, MA; D.C. Heath and Company (1980).

From Modeling the multiregional economic system; Chestnut Hill, PA, USA (14 Jun 1979).

The multiregional multiindustry (MRMI) model was constructed to address the ever-present need of policymakers for an analytical/forecasting model with sufficient regional/industrial detail which could capture the interregional and interindustry dependencies of economic activities. Furthermore, in order for the MRMI to be realistic and useful in a wide range of applications, it was designed specially to embody major theoretical concepts essential to regional economic analysis. A brief discussion of the major attributes of the MRMI model, a discussion on how the model works, a review of the MRMI data base, a discussion of the statistical estimation procedures, and a summary of the applications of the model in policy and program analysis are presented. The MRMI model in conjunction with the Inforum model can be used to analyze a wide range of public and private policies and programs. When MRMI and Inforum are used together both national and regional impacts can be estimated. A broad range of specialized applications has been carried out, including regional effects of alternative highway systems, transportation investment, impact of offshore petroleum development, impact of coal and solar energy development, effect of natural gas shortages, and impact of the auto industry on the Detroit region.

3201 Buildings

REFER ALSO TO CITATION(S) 13595, 13613, 13655, 13676, 13682, 13691, 13693, 13694, 13702, 13718, 13719, 13720, 13722, 13723, 13724, 13727, 13733, 13734, 13740, 13741, 13743, 13745, 13748, 13792, 14108, 14111, 14175, 14213, 14318, 14345

14229 **(DOE/CS—0209) Weatherization assistance program. Annual report for 1980.** (Department of Energy, Washington, DC (USA)). Nov 1980. 54p. NTIS, PC A04/MF A01.

This addresses three major areas of concern relating to weatherization activities: (1) extent of progress being made toward achievement of national energy-conservation goals; (2) adequacy and costs of materials; and (3) need for and desirability of modifying weatherization activities and of extending such activities to a broader range of income groups, including changes to the legislation necessary to accomplish these modifications. The report concentrates on the efforts of the Department of Energy's (DOE) program for Weatherization Assistance for Low-Income Persons.

Among the most-significant innovations introduced to the program in 1980 are: performance funding (granting funds on the basis of proven production capability), payment for labor and contractors, inexpensive interim measures, and more flexibility in determining eligibility for multi-family buildings. In addition, the program improved communications with the Department of Labor (DOL) and the Community Services Administration (CSA) as well as with representatives of the local program operators. Headquarters staffing was strengthened in 1980, and a management agreement was signed.

14230 **(DOE/CS/20184—T1) Energy consumption in commerical buildings: a comparison with BEPS budgets.** (Hagler, Bailly and Co., Washington, DC (USA)). 22 Sep 1980. Contract AC01-79CS20184. 58p. NTIS, PC A04/MF A01.

Metered energy consumption data have been collected on existing commercial buildings to help establish the proposed Building Energy Performance Standards (BEPS). The search has identified 84 buildings whose metered energy consumption is equal to or less than that proposed for their BEPS budgets and another 7 buildings whose metered consumption is less than 20% above their BEPS budgets. The methodology used to identify the buildings and to collect their metered energy consumption data are described. The data are analyzed and summarized and conclusions are drawn.

14231 **(DOE/CS/20346—T1) Analysis provided to assist the development of a certification and enforcement program for consumer-product efficiency standards. Final report.** (Vitro Labs., Silver Spring, MD (USA)). 16 Feb 1981. Contract AC01-78CS20346. 10p. NTIS, PC A02/MF A01.

The Energy Policy and Conservation Act (EPCA) authorized DOE to implement an energy-conservation program for major household consumer products. Included in this legislation is a mandate to establish minimum energy-efficiency standards for each type or class of covered consumer product. In order to assure compliance by all manufacturers, procedures must be developed and implemented to permit DOE to verify that each manufacturer's products meet or exceed the prescribed efficiency standard. Vitro Laboratories performed analysis to assist DOE in developing a Certification/Enforcement Program for Consumer-Product Efficiency Standards meeting the requirements of EPCA. The specific work performed was defined by three tasks under the orginal contract and five tasks under a subsequent modification of the contract. Each task is described.

14232 **(DOE/CS/20346—T2) Supplementary analysis of impacts of alternative approaches for the Certification/Enforcement Program for consumer-product energy-efficiency standards.** (Vitro Labs., Silver Spring, MD (USA)). 4 Aug 1980. Contract AC01-78CS20346. 58p. NTIS, PC A04/MF A01.

Vitro Laboratories Task 2 Report developed and qualitatively evaluated 4 alternative approaches for a DOE program for the certification and enforcement of consumer-product energy efficiency standards. This Task 5 report provides supplemental resource impact analyses of the four (a minimal governmental intervention approach, a strong certification control approach, a strong enforcement audit approach, and a mixed certification/enforcement approach) approaches. This analysis derives quantitative estimates of the impacts of these alternative approaches in terms of the five key decision variables defined in Task 2 (DOE staffing requirements, DOE program costs, test costs, indirect costs, and level of compliance). Definitions and assumptions of the resource-impact analyses of the four alternative certification and enforcement approaches are described for furnaces and boilers, water heaters, refrigerators and refrigerator/freezers, kitchen ranges and ovens (gas only), central air conditioners, and freezers. The next 5 chapters are dedicated to discussions of the five key decision variables. Results of the comparative evaluation are presented in the final chapter.

14233 **(DOE/CS/20346—T4) FTC data analysis.** (Vitro Labs., Silver Spring, MD (USA)). 11 Feb 1981. Contract AC01-78CS20346. 59p. NTIS, PC A04/MF A01.

Manufacturers of 5 major consumer products submitted energy efficiency and related data to the Federal Trade Commission during late 1979 and early 1980 in response to energy-efficiency labeling and representations requirements. This report documents an analysis of these data as conducted by Vitro Laboratories. Data were submitted on five products: furnaces, water heaters, room air conditioners, refrigerators and refrigerator-freezers, and freezers. The submittals include information on manufacturer model number, estimated annual energy cost or the energy-efficiency rating, the number of tests performed on each basic model, and the capacity of each appliance model. Pattern analyses on these variables are presented, but it is observed that few common patterns for the five products exist. The unique patterns for each product are discussed.

14234 **(DOE/CS/20346—T7) Enforcement/certification program for appliance efficiency standards. Task I report.** (Vitro Labs., Silver Spring, MD (USA)). 12 Feb 1979. Contract AC01-78CS20346. 128p. NTIS, PC A07/MF A01.

The structure and features of selected certification programs were evaluated, their operational characteristics determined, and primary program problems and successes identified. An initial review of 50 certification programs in the Federal, state, and private sectors was performed, followed by a detailed review of 8 of the programs (EPA New Product noise; EPA Automobile Emissions, AHAM Room Air Conditioners; ARI Unitary Air Conditioners/Heat Pump; NHTSA Automobile Tire Safety; California Applicance Standards; Underwriters Laboratories Product Safety; and Ford's Quality-Assurance Program for Suppliers). Flow charts are presented to illustrate each program's structure and major characteristics. Matrices are developed to list the operating and control features of each program. Analyses of the 8 selected programs were performed to the degree necessary to develop and propose 5 potential approaches to an appliance certification/enforcement program (minimal intervention, strong certification control, strong enforcement audit, balanced certification and enforcement and strong enforcement remedies and deterrents). The approaches are documented in Section 3. The evaluation framework is described in Section 4, while a review of final test procedures and related public testimony are given in Section 5. (MCW)

14235 **(DOE/CS/20346—T8) Enforcement/certification program for appliance efficiency standards. Task II, report.** (Vitro Labs., Silver Spring, MD (USA)). 28 Sep 1979. Contract AC01-78CS20346. 176p. NTIS, PC A09/MF A01.

The research and analysis program at Vitro Labs. in support of the appliance certification and enforcement program provides Vitro's recommended approach to appliance certification and enforcement (C/E). The approach established the C/E program framework, general criteria, and procedures for assuring a specified level of energy-efficiency performance for 13 categories of consumer products (furnaces, humidifiers, dehumidifiers, dishwashers, television, clothes washers, freezers, air conditioners, stoves, refrigerators, water heaters). Section 2 summarizes the recommended approach. Section 3 contains detailed evaluations and comparisons for four independent alternative approaches considered (minimal government intevention, strong certification control, strong enforcement audit, and mixed certification/enforcement). The fifth C/E approach (strong remedy/deterrent) involves the remedies available to the government should non-compliance be discovered and could affect the choice among the approaches, but this approach has not been evaluated. Section 4 summarizes the analysis methodology used to select the recommended approach. Additional information is provided in 6 appendices.

14236 **(DOE/CS/20346—T9) Certification reporting forms.** (Vitro Labs., Silver Spring, MD (USA)). 18 Feb 1981. Contract AC01-78CS20346. 24p. NTIS, PC A02/MF A01.

The required information and formats for the certification report including the cover sheet, compliance statement, and body of the report are given in this document. The body of the reports is different for each product. There are no product-to-product differences in the forms of the other parts of the reports. The products covered in this document include: furnaces, water heaters, refrigerator-freezers, central air conditioners, room air conditioners, and freezers.

14237 **(DOE/EIA/TR—0244) Selected comments on the ORNL Residential Energy-Use Model.** Herbert, J.H. (Department of Energy, Washington, DC (USA). Energy Information Administration). Jun 1980. 13p. NTIS, PC A02/MF A01.

This report assesses critical technical aspects of the Oak Ridge National Laboratory (ORNL) Residential Energy Use Model. An important component of the ORNL Model is determination of the thermal performance of new equipment or structures. The examples presented here are illustrative of the type of analytic problems discovered in a detailed assessment of the model. A list of references is appended.

14238 **(DOE/R5/10149—2) Microprocessor control of a ground water heat pump. Final report.** (Telesis Lab., Chillicothe, OH (USA)). 1980. Contract FG02-79R510149. 58p. NTIS, PC A04/MF A01.

This project was a demonstration of the energy savings available to a small well-insulated facility when a properly designed heat pump is operated against a source of constant temperature ground water or pond water. To date, we have assembled the electronic logging devices required to prove the resultant savings. Data to date, (15 November, 1980) is sparse as we are just entering a full heating season. It is expected that a complete data log will be submitted next spring. Initial energy savings computations follow - the system efficiency is impressive. A typical winter day savings is about $24.00 or $720.00 monthly. The system utilizes the 55°F ground water directly for summer cooling. The summer savings are estimated to be about $18.00/day or $540.00 monthly. Circuits and diagrams of the microprocessor control system and data logger are presented. Some sample data are included. (WHK)

14239 **(EPRI-EM—1722) Evaluation of transient voltage suppressors for saving electric energy. Final report, February 1981.** Saunders, D.N.; Galler, D. (Kusko (Alexander), Inc., Needham Heights, MA (USA)). Feb 1981. 93p. NTIS, PC A05/MF A01.

Transient voltage suppressors were introduced in the early 1970's to protect electronic and electrical equipment from voltage transients originating in the electric power supply system. Since their introduction, these suppressors have also been sold to the public as a means for saving electric energy, on the basis that they clean up the transients that would reduce the efficiency of transformers, motors, lamps, and other load devices. In this report, field test data, laboratory test results, and theoretical analyses have been examined to determine the validity of the claims that suppressors can save energy. It is found that the field tests comparing energy consumption before and after the installation of suppressors were either poorly controlled, showed no energy saving, or were reported erroneously. The laboratory tests showed no increase in energy consumed by load devices subjected to a shower of transients, and no reduction of energy usage after installation of suppressors at loads operating in typical environments. Furthermore, the theoretical analyses for energy saving, based on the amplification mechanism of the transient energy, were shown to have no validity. During this investigation, no theoretical or experimental basis for the claim that transient voltage suppressors are capable of reducing the consumption of electric energy was found.

14240 **(EUR—6598DE) Dependence of energy use in electric water heating on the equipment and demand. Part 1. Investigation of electric water heaters; Part 2. Investigation of mixing equipment.** Schaefer, H.; Gossenberger, M.; Prechtl, H.; Steinberger, W.; Wiesner, B. (Gesellschaft fuer Praktische Energiekunde, Muenchen (Germany, F.R.)). 1979. 215p. (In German). NTIS (US Sales Only) PC A10/MF A0.

Measurements of stand-by losses and of energy requirements in various operational phases and under actual operating conditions were carried out on six different electrical water heaters (a 300-litre storage tank, an 80-litre storage tank, a 30-litre continuous-flow storage tank, and three different continuous-flow heaters). The stand-by losses for the individual appliances, some of which varied considerably, and practically all of which were dependent on temperature, resulted in widely varying degrees of efficiency when demand was low; but when demand was high these losses became less important. However, appliances which perform more favorably from the energy-saving point of view may not fully satisfy all demands on comfort and not be able to meet peak consumption figures. Furthermore, they are dependent on technical conditions which are not to be found in all cases. Measurements were carried out on three mixers (dual control, single control, and thermostatic control) of the energy performance under stationary conditions and under the influence of the malfunctions which may occur during use. The thermostatically controlled mixer is the most desirable from the energy point of view under all conditions, above all because automatic temperature regulation eliminates the negative influence of careless handling. However, its price is such that no consumer will decide to buy it exclusively or mainly because of its optimum energy utilization.

14241 **(LBL—12176) Optical interference coatings for improved luminaire performance. Final report.** Rubins, H.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Optical Coating Lab., Inc., Santa Rosa, CA (USA)). Jan 1981. Contract W-7405-ENG-48. 105p. NTIS, PC A06/MF A01.

An interior broadbeam HID uplight and an upstream roadway luminaire were developed to demonstrate that optical coated luminaire components can improve the visual effectiveness and energy efficiency of a lighting system. Optical coated reflectors and flat lens covers were very effective in the development of new improved lighting techniques. The coatings reduce reflection and transmission losses, opening the door to new design options for improving lighting performance and saving energy.

14242 **(LBL—12253) Analysis of the energy impacts of the DOE Appropriate Energy Technology Small Grants Program: methods and results.** Lucarelli, B.; Kessel, J.; Kay, J.; Linse, J.; Tompson, S.; Homer, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Feb 1981. Contract W-7405-ENG-48. 45p. NTIS, PC A03/MF A01.

In 1977, Congress directed DOE to create an energy grants program with the object of funding individuals, small businesses, and nonprofit organizations to develop technologies that use renewable energy resources. The Small Grants Program was created and this report assesses the energy savings potential of the program. The first step in the analysis was to assess the energy-savings potential of 57 projects. Program energy savings were then estimated from project savings using statistical inference. Chapter 2 presents estimates of direct energy savings for the 57 projects and discusses direct energy savings. Chapter 3 discusses the methods and results of the economic analysis. Chapter 4 examines the indirect savings. Because of the large size of the sample, neither project descriptions nor specific details of each project analysis are included. Instead, two examples from the analysis are presented in Chapters 2, 3, and 4 to illustrate the methods. The results of the analysis and key project data are summarized. Chapter 5 presents estimates of program energy savings and the methods used to obtain them. The report concludes with a discussion of how improved project selection can increase program energy savings and present two approaches for conducting future energy-impact studies.

14243 **(NP—25289) Electric Utility Rate Design Study: survey of commercial/industrial consumers on mandatory time-of-use electricity rates.** (Elrick and Lavidge, Inc., San Francisco, CA (USA)). 7 Apr 1980. 147p. EPRI, Palo Alto, CA.

This study provides information that would be of value to the Electric Utility Rate Design Study in assessing the attitudes/opinions and load-shifting practices of commercial and industrial customers under mandatory time-of-use rates. The five utilities deemed appropriate for study since each utility would have been under mandated time-of-use rates for at least one year when their customers were surveyed were: Commercial Edison; Pacific Gas and Electric; Southern California Edison; Wisconsin Electric Power Company; and Wisconsn Power and Light. The findings secured from a survey of 515 businesses billed on time-of-use electricity rates for a minimum of one year are discussed. Chapter I summarizes customers' understanding of time-of-use rates. Knowledge of specific aspects of the rate structure is probed. Chapter II focuses on the customers' preference for time-of-use rates as opposed to

their former rates. Chapter III delves into the extent to which businesses have shifted demand and energy usage away from on peak times to off peak times. Underlying causes of changes in demand and energy consumption patterns are also presented. Finally, in Chapter IV, the characteristics and mix of businesses within each of the five utility service areas are recognized. Such aspects as maximum kW demand level and number of employees are tabulated.

14244 **(ORNL/CON—58) Review of evaluations of utility home-energy-audit programs.** Berry, L.; Soderstrom, J.; Hirst, E.; Newman, B.; Weaver, R. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 78p. NTIS, PC A05/MF A01.

Evaluation efforts of utilities with active home energy audit programs are reviewed to suggest methodologies, issues, and data that can contribute to the development of a comprehensive Residential Conservation Service evaluation plan. About half of the utilities contacted had little or no evaluation activity. Of those with evaluation activity, most conducted only informal evaluations for in-house use. A few utilities had conducted fully documented formal evaluations. On the basis mainly of written reports received from the utilities, findings about customer response to programs are summarized. The topics discussed include: correlates of program penetration rates, use of financing, attitudes toward programs, actions taken, characteristics of participants and energy savings due to programs. Methodological issues raised by the utility evaluation efforts are discussed. Particular attention is given to three studies (Tennessee Valley Authority, Seattle City Light, and Pacific Gas and Electric) that analyze fuel consumption records as part of the evaluation. The potential contributions of these three studies, and of other evaluation efforts, to designing an RCS evaluation are explained.

14245 **(ORNL/CON—68) Residential energy use and conservation actions: analysis of disaggregate household data.** Hirst, E.; Goeltz, R.; Carney, J. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 70p. NTIS, PC A04/MF A01.

The Energy Information Administration recently published data they collected from the National Interim Energy Consumption Survey (NIECS). NIECS includes detailed information on 4081 individual households: demographic characteristics, energy-related features of the structure, heating equipment and appliances therein, recent conservation actions taken by the household, and fuel consumption and cost for the April 1978 to March 1979 one-year period. This data set provides a new and valuable resource for analysis. The NIECS data on household energy consumption - total energy use, electricity use, and use of the primary space heating fuel, are summarized and analyzed. The regression equations constructed explain roughly half the variation in energy use among households. These equations contain ten or fewer independent variables, the most important of which are fuel price, year house was built, floor area, and heating degree days. Regression equations were developed that estimate the energy saving achieved by each household based on their recent retrofit actions. These equations predict 20 to 40% of the variation among households. Total annual energy use is the most important determinant of retrofit energy saving; other significant variables include age of household head, household income, year house was built, housing tenure, and proxies for the cost of heating and air conditioning the house.

14246 **(ORNL/Sub—7559/2) Problems associated with the use of urea-formaldehyde foam for residential insulation. Part II. The effects of temperature and humidity on free formaldehyde, extractable formaldehyde, formaldehyde emission, and physical characteristics of the foam.** Schutte, W.C.; Cole, R.S.; Frank, C.W.; Long, K.R. (Oak Ridge National Lab., TN (USA); Iowa Univ., Oakdale (USA). Dept. of Preventative Medicine and Environmental Health). Feb 1981. Contract W-7405-ENG-26. 89p. NTIS, PC A05/MF A01.

Results of testing with two products of urea-formaldehyde based foams are described. Results of three products have previously been reported. Methods for detection and quantitative determination of formaldehyde, design of the experimental chambers, and the procedures are described. Samples of Product D were monitored for about 29 days and samples of Product E were monitored for 60 days in chambers and results are tabulated for formaldehyde emission. Additional tests performed on the two products are: extractable formaldehyde (high and low temperature conditions); free formaldehyde (high and low temperature conditions); comparison of free formaldehyde concentration; density (high and low temperature conditions); shrinkage (high and low temperature conditions). Control panels were constructed to simulate a wall in a home and observations were made and compared with results of the experimental products.

14247 **(PB—80-173644) Assessment of integrated urban energy options.** Pine, G.D. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Feb 1979. 236p. NTIS, PC A11/MF A01.

An initial comparison is carried out for the following residential space and water heating options: electric resistance heating, electrically-driven heat pumps, distribution of condenser temperature water combined with heat pumps to extract heat at the point of use, district heating via hot water from a combined heat-electric utility energy source, and individual gas furnaces. This comparison indicates that district heating is potentially competitive with conventional technologies for new urban areas. A more detailed analysis of the district heating option is undertaken to clarify its economics. Base case urban models, economic assumptions, and distribution networks are defined and a computer program is developed to select optimum pipe sizes for the networks and to calculate life cycle costs. Cost optimization is carried out by considering thermal energy production costs as well as thermal conveyance costs. Several potential institutional barriers to district heating system implementation are identified.

14248 **(PB—80-183445) HUD utilities demonstration series. Volume 15, part 1. Design cost and operating data for alternate energy systems for the Summit Plaza Complex, Jersey City, NJ. Final report.** (Nottingham (H.D.) and Associates, Inc., McLean, VA (USA)). May 1979. 315p. NTIS, PC A14/MF A01.

This report develops basic design and operating data for a comparison of alternative methods of supplying heating, cooling and electric power to a residential/commercial complex. The community complex studied is the Summit Plaza Development located in Jersey City, New Jersey which has been served since January, 1974, by a Total Energy (TE) plant. The Summit Plaza TE project is a demonstration effort of the U.S. Department of Housing and Urban Development (HUD) currently being administered by the National Bureau of Standards (NBS) for analysis of the performance and overall viability of the Total Energy facility. Included in the scope of this study is the following: (1) Analysis of the installed energy system; (2) Conceptual design of alternate energy systems; (3) Estimates of the capital costs of the existing system and each alternate system; (4) Estimates of the operation and maintenance costs of the existing system and alternate systems; (5) Simulation of the energy systems operating through a typical year to determine energy demands and consumptions. The data in this report are incorporated into the Final Report being prepared by NBS for the HUD Total Energy Demonstration Project. The Final Report will compare the energy, economic, reliability, and environmental viability of each energy system.

14249 **(PB—80-183452) HUD utilities demonstration series. Volume 15, part 2. Detailed initial cost data for alternate energy systems for the Summit Plaza Complex, Jersey City, NJ. Final report.** (Nottingham (H.D.) and Associates, Inc., McLean, VA (USA)). May 1979. 142p. NTIS, PC A07/MF A01.

This report presents detailed estimates of the construction cost of 12 alternative energy systems which could supply heating, cooling and electrical services to the Summit Plaza Complex. Construction costs are developed for each system in the report by a quantity take-off for all major and minor equipment for each energy system including the individual electrical and mechanical components of the energy conversion equipment, site distribution, equipment, building terminal equipment etc. The detailed data in the report is summarized in a related report in which the energy performance and costs for the energy system were developed:

Design, Cost and Operating data for Alternative Energy Systems for the Summit Plaza Complex, Jersey City, NJ.

14250 **(PB—80-195654) Illinois State Plan: energy conservation in institutions, Institutional Buildings Grant Program.** Thomas, S.K.; Tuma, S.L.; Shum, J. (Illinois Inst. of Natural Resources, Springfield (USA)). 5 Dec 1979. 99p. NTIS, PC A05/MF A01.

This Plan addresses very narrow April 17, 1979 Federal Register requirements as spelled out in paragraph 455.42 and is meant to show the Institute's strategies and commitments to achieve full implementation of this Energy Grant Program in Illinois. The Program provides for Federal grant monies on a 50/50 cost-sharing basis to be given to eligible schools/hospitals/public care/local units of government to both conduct in-depth Professional Engineering Analysis of each of the applicant's buildings and finally to enable the procurement and installation of some or all of the report retrofit recommendations on the same cost share basis.

14251 **(PB—80-205321) Research, development, and demonstration of a high-efficiency gas-fired water heater. Annual report for 1979.** Zawacki, T.S.; Zimmer, J.W.; Macriss, R.A. (Institute of Gas Technology, Chicago, IL (USA)). Jan 1980. Contract GRI-5011-345-0093. 77p. NTIS, PC A05/MF A01.

A near term, high efficiency, prototype gas-fired, storage water heater was designed and constructed, utilizing a new flue passage design and a companion flue baffle (or turbulator) to increase the rate of heat transfer. Using DOE's test procedure methodology for gas-fired water heaters, the maximum seasonal average daily gas consumption of the advanced prototype was determined.

14252 **(PB—80-205354) Energy efficiency improvement of residential and commercial gas appliances. Phase I. Research, development and demonstration planning. Annual Report for 1979.** Pickett, P.E.; Racine, W.C.; Peterka, D.L.; Erickson, R.C. (Science Applications, Inc., La Jolla, CA (USA)). Apr 1980. Contract GRI-5011-345-0095. 299p. NTIS, PC A13/MF A01.

Energy efficiency improvement design concepts for residential and commercial gas water heaters, cooking equipment and clothes dryers were examined in this study. The following items relating to the efficiency improvements were examined: possible annual natural gas savings; economic factors of payback period and change in life cycle cost; durability and serviceability; utility and consumer appeal; legal and marketplace barriers; past or current related work. Using these items as criteria, an evaluation procedure was applied to all design concepts.

14253 **(PB—80-205388) Development and demonstration of a Stirling/Rankine heat activated heat pump. Semi-annual report, January-June 1979.** Meier, R.C. (General Electric Co., Philadelphia, PA (USA). Space Div.). Oct 1979. Contracts DOE-EC-77-C-02-2911;GRI-5010-341-0052. 134p. NTIS, PC A07/MF A01.

Testing of a residential size, free-piston Stirling engine combined with a free-piston linear compressor, gas fired heat pump has been completed. During the course of this work, performance and operating characteristics of the system and its components were established. Testing of the first prototype was instrumental in determining those design modifications needed to achieve performance goals. A field test prototype was fabricated, and a gas utility sponsored test home was selected.

14254 **(PB—80-205396) Development and field verification of a model of excess infiltration and house air infiltration for single-family residences. Final report for 1979.** Cole, J.T.; Zimmer, J.W.; Zawacki, T.S.; Kinast, J.A.; Elkins, R.H. (Institute of Gas Technology, Chicago, IL (USA)). Jan 1980. Contract GRI-5014-341-0111. 53p. NTIS, PC A04/MF A01.

This report discusses a generalized model of air infiltration, partial refinement of the model by the development (and inclusion into the model) of 3 support models (for total crackage, wind shielding and structural permeability), and partial verification of the model by comparison to detailed, measured house infiltration data obtained by other investigators in 2 test homes. The report also presents a review of literature air infiltration models and of their limitations.

14255 **(PB—80-205404) Development of a residential sized gas fired absorption heat pump. Annual report, January-October 1979.** Allen, R.A.; Murphy, K.P. (Allied Chemical Corp., Morristown, NJ (USA)). Apr 1980. Contract GRI-5014-341-0113. 93p. NTIS, PC A05/MF A01.

The development program for a residential gas-fired absorption heat pump is described. The unit, based on a new absorption pair, is designed to supply 36,000 Btu/Hr cooling and 90,000 Btu/Hr heating. Component and system development are described as are the physical-thermodynamic properties of the fluids.

14256 **(PB—80-205438) Heat recovery devices - new. Final report, 1 March-31 October 1979.** Syska, A.J.; Brzezinski, A. (Thermal Systems Engineering, Inc., Woburn, MA (USA)). Apr 1980. Contract GRI-5011-341-0121. 50p. NTIS, PC A03/MF A01.

A concept was developed for a compact and lightweight jet impingement recuperator suitable for recovering heat from residential and commercial gas fired heating systems. Heat transfer and pressure drop analyses were completed confirming feasibility of the concept. Preliminary, cost effective design for the recuperator was also completed and optimized for compactness and for low pressure drop compatible with natural chimney drafts.

14257 **(PB—80-205461) Open cycle vapor compression heat pump. Annual report for 1979.** Sakhuja, R.; Becker, F.E. (Thermo Electron Corp., Waltham, MA (USA)). Jul 1980. Contract GRI-5011-342-0094. 45p. NTIS, PC A03/MF A01.

A compressor test facility was built incorporating a screw compressor modified for steam service. The compressor was tested over a wide range of operating conditions with experimental results showing excellent agreement with predicted performance. The compressor operation with wet steam and water injection was completely satisfactory, demonstrating its suitability for use in a steam heat pump system.

14258 **(PB—80-810914) Heat loss detection of buildings. 1964-April 1980 (citations from the NTIS data base). Report for 1964-April 1980.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 85p. NTIS PC N01/MF N01.

The citations in this bibliography describe various methods for displaying or determining heat loss in residential buildings, commercial buildings, and house trailers. These methods disclose sources of heat loss such as structural defects, moisture spots, and other anomalies in building envelopes. Thermography, infrared detection, tracer gases, time-response methods, and statistical predictions are among the methods used for heat loss determination. (This updated bibliography contains 78 abstracts, 15 of which are new entries to the previous edition.)

14259 **(PB—80-812423) Energy conservation: buildings. 1977-June, 1980 (citations from the NTIS Data Base). Report for 1977-Jun 80.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 311p. NTIS PC N01/MF N01.

Energy conservation in residential, commercial, and industrial buildings through use of efficient heating, air conditioning, and lighting systems is discussed. Topic areas cover the retrofitting of existing buildings, efficient use of electric power, and economics of energy conservation options. A few abstracts deal with general studies on the potential for conserving energy in buildings and guidelines for building owners. Subject areas excluded from this bibliography but available as separate Published Searches are energy conservation through building design, waste heat utilization, total energy systems, and heat pumps. (This updated bibliography contains 305 citations, 78 of which are new entries to the previous edition.)

14260 **Electric Utility Rate Design Study: a framework for evaluating the cost-tracking capabilities of alternative residential rate structures.** Palo Alto, CA; Electric Power Research Institute (1980). 76p. (NP—25302). EPRI, Palo Alto, CA.

A framework for evaluating the relative cost-tracking ability of declining-block-rate structures, the most common rate form presently applied to residential and small commercial electric-utility service, is developed. A cost-tracking rate structure is defined as a tariff that allocates revenue requirements in such a way that the revenues collected from an individual customer closely track the costs which that customer imposes on the utility. A perfect cost-tracking rate structure is not achievable in practice. There are practical constraints on rate design that arise from technical considerations such as metering capabilities, administrative feasibility, and the requirement that rate structures be simple and understandable. The framework for tracking costs proposed in this study makes use of regression techniques to design and evaluate rate schedules. A stepwise least-squares regression routine selects the best set of rates for a given rate structure in an essentially unconstrained fashion. Several unique advantages of the procedure are discussed. This methodology was tested empirically using load research and cost of service data for residential customers of Virginia Electric and Power Company. The study demonstrates that the cost-tracking performance of declining block rates is, in the case of VEPCO, rather good.

14261 **Pattern language method for energy-responsive design.** Lentz, C.B. pp 140-143 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A method has been developed for use in the design of buildings which will consume minimal amounts of fossil fuel energy. Based on the pattern language format developed by Christopher Alexander, this design method can be applied to any site. 1 ref.

14262 **Residential building simulation model comparison using several building energy analysis programs.** Gadgil, A.; Goldstein, D.; Kammerud, R.; Mass, J. (Univ of Calif, Berkeley). pp 187-190 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Heating and cooling load calculations for conventional residential buildings have been performed using four computer programs. It is shown that more detailed modeling of convective processes can substantially alter the predicted thermal behavior of buildings. 7 refs.

14263 **Extension of methods used for analyzing passive solar systems.** Cumali, Z.O.; Sezgen, A.O.; Sullivan, R.; Kammerud, R.C. pp 196-199 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper describes several new building energy analysis procedures which have been developed. Though these techniques have been motivated by the need for improved passive solar building analysis and design tools, they also represent a significant advancement in the capability to analyze more conventional structures. 6 refs.

14264 **Method to abbreviate hourly climate data for computer simulation of annual energy use in buildings.** Arens, E.; Flynn, L.; Nall, D. (NBS, Washington, DC). pp 282-286 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A building's future energy performance is commonly estimated by simulating its thermal behavior over a "typical" year representative of the most statistically probable future climate. Such annual hour-by-hour computer analysis is time-consuming and costly. The paper finally discusses the potential for using the technique for other applications, such as creating typical years and synthesizing hourly data for sites for which there are only summarized data. 4 refs.

14265 **Current research into the effectiveness and acceptability of earth sheltered buildings as a passive energy conservation technique.** Sterling, R.L. (Univ of Minn, Minneapolis). pp 425-428 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper discusses the current activity and, in particular, the current research efforts in the area of earth sheltered building design, construction, and acceptance. There is also a brief introduction to the concept. 1 ref.

14266 **Mean radiant temperature and its effects on energy conservation.** Smith, D.L. (Univ of Cincinnati, Ohio). pp 431-435 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper reviews the standard formulas for determining body thermal transfer under comfort conditions and concludes that radiant transfer is the primry means of dissipating excess body heat. 6 refs.

14267 **Cost effectiveness of landscaping for energy savings: a case study.** Hansen, D.G.; Mandraes, D. (TVA, Knoxville, Tenn). pp 476-479 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper is a case study which utilizes a simplified estimate for determining the cost effectiveness of carefully placed minimal landscaping. It was found that because of poor fenestration orientation, the payback period for landscaping designed to reduce direct solar radiation on the areas of fenestration was very short.

14268 **Effect of IR transparent windscreens on net nocturnal cooling from horizontal surfaces.** Clark, G.; Blanpied, M. (Trinity Univ, San Antonio, Tex). pp 509-513 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The results of rigorous simulations of the effects of various windscreens on the net nocturnal cooling is presented. Net nocturnal cooling is graphed as a function of the temperature of the radiator for an exposed horizontal radiator. 8 refs.

14269 **Design procedure for underground air cooling pipes based on computer models.** Nordham, D.B. (Sol Energy Res Inst, Golden, Colo). pp 525-529 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A simple analysis method is developed which allows for sensitivity studies of candidate designs for subterranean air conditioning pipes and ventilation systems. These studies are based upon simulated digital computer models using iterative heat balance algorithms for specific ambient conditions and defined thermal network parameters. 8 refs.

14270 **Thermal performance of ventilated skin roofs.** Morgan, C.F. (Univ of Fla, Gainesville). pp 719-722 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

The thermal characteristics of a ventilated skin roof are investigated under several controlled steady-state conditions. Temperature and air flow data is gathered and analyzed in order to establish the convective performance of the ventilating air stream as well as the heat transfer processes of the other roof components. 3 refs.

14271 **Seasonal variation in heat transfer through earth embanked wall.** Newman, J.O. (USDA, Clemson, SC). pp 739-743 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

Heat loss from houses can be reduced economically using earth embanked walls. The RHRU-USDA has found that soil temperatures vary considerably from season to season, and that heat loss can be reduced more than 60% by using earth embanked walls.

14272 **Thermal analysis of earth covered buildings.** Davies, G.R. (Univ of Cincinnati, Ohio). pp 744-748 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

A detailed finite difference model was developed to predict transient heat transfer from earth covered buildings. The model allows user input of structure geometry, thermal parameters, and random indoor and outdoor temperature profiles. A comparison was made with two other analytical methods to demonstrate the shortcomings of existing techniques. 10 refs.

14273 **Drilling for oil and gas in our buildings.** Ross, M.H.; Williams, R.H. Princeton, NJ; Princeton University (1979). 34p. (PU/CEES—87).

A potential energy crisis in the 1980s can be averted if the giant oil and gas fields represented by buildings are "drilled" to recover the wasted gas and oil. The author proposes a method whereby half the energy now consumed for heating, equivalent to 2 1/2 million barrels of oil per day or 2/3 our present dependence on Arab and Iranian oil, can be saved. The proposed program for energy conservation in housing involves a Retrofit Pilot Project; a training program for persons who understand housing from the thermal standpoint can identify by direct inspection the important thermal attributes of a small building, and are thoroughly familiar with effective retrofits on most housing types in the region; and the financing measures. Specifically, an Oregon plan providing a mechanism for achieving the optimal level of investment is described. It does provide a compelling incentive. The energy bill for participating consumers should drop markedly, since the interest payments on the investments are spread over all customers. Some calculations are presented to illustrate energy saved and the economics of the measures implemented. (MCW)

14274 **(DOE/R5/10121—3) Insulation from basaltic stamp sand. Final technical report.** Williams, F.D. (Michigan Technological Univ., Houghton (USA). Dept. of Chemistry and Chemical Engineering). [nd]. Contract FG02-79R510121. 173p. NTIS, PC A08/MF A01.

A Midwest Appropriate Technology Grant was awarded to determine the technical and economic feasibility of producing mineral-fiber insulation directly from extensive deposits of basaltic sand produced during former mining and milling operations in the Keweenaw Peninsula region of Michigan's Upper Peninsula. The amounts of local basaltic sands available and representative chemical compositions were determined. The variation of viscosity with temperature and chemical composition was estimated. Samples were melted and either pulled or blown into fiber. In all cases fiber could be made with a reasonable tensile strength to ensure usefulness. It was concluded that it was technically feasible to produce fibers from basaltic stamp sands of the Upper Peninsula of Michigan. A technical feasibility study using published data, a cost and design analysis of a basalt fiber production plant, a market survey of fiber needs, and an economic analysis for investing in a basalt fiber venture was undertaken. These studies concluded that the local production of basaltic insulation was both feasible and economically reasonable. It was suggested that the plant be located in a region of greater population density with lower utility costs. A representative one-third of these studies is included as appendices A, B, C, and D.

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14275 **(AD-A—087498) The fuel efficient missile combat crew routing network. Master's thesis.** Jacques, E.O. Jr.; Woolley, M.G. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Jun 1980. 127p. (AFIT-LSSR—19-80). NTIS, PC A07/MF A01.

Missile combat crew vehicles are the highest mileage accumulators within SAC and, in the interest of energy conservation, Vice CINCSAC has initiated a long-term study examining utilization of more fuel efficient crew vehicles. This thesis extends the SAC study by determining if alternate dispatch procedures and routes of travel, using currently assigned vehicles, would result in fuel conservation. A network routing model is used to determine the routes of travel for three deployment strategies and five vehicle types at the Minot AFB, ND test base. Fuel efficiency for these fifteen alternatives, measured as gallons of fuel consumed per passenger, is compared with the existing missile combat crew routing network. This study found that ten of the fifteen vehicle/deployment strategy combinations, when employed over the shortest authorized routes of travel that were developed, provided improvement over the fuel efficiency of the MCC routing system that was in effect as of 31 August 1979. The largest potential savings amounted to 52% or 26,255 gallons of fuel per year.

14276 **(AD-A—087653) General aviation activity and avionics survey. 1978. Annual summary report cy 1978.** Schwenk, J.C. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Mar 1980. 161p. NTIS, PC A08/MF A01.

This report presents the results and a description of the 1978 General Aviation Activity and Avionics Survey. The survey was conducted during early 1979 by the FAA to obtain information on the activity and avionics of the United States registered general aviation aircraft fleet, the dominant component of civil aviation in the U.S. The survey was based on a statistically selected sample of about 13.3 percent of the general aviation fleet and obtained a response rate of 74 percent. Survey results are based upon responses but are expanded upward to represent the total population. Survey results revealed that during 1978 an estimated 39.4 million hours of flying time were logged by the 198,778 active general aviation aircraft in the U.S. fleet, yielding a mean annual flight time per aircraft of 197.7 hours. The active aircraft represented 85 percent of the registered general aviation fleet. The report contains breakdowns of these and other statistics by manufacturer/model group, aircraft type, state and region of based aircraft, and primary use. Also included are fuel consumption, lifetime airframe hours, avionics, and engine hours estimates.

14277 **(BNL—28778) Modern alternative to oil-fired ships.** Botts, T.E.; Powell, J.R.; Powell, J.D. (Brookhaven National Lab., Upton, NY (USA); Scripps Institution of Oceanography, La Jolla, CA (USA)). 1980. Contract AC02-76CH00016. 6p. (CONF-801210—23). NTIS, PC A02/MF A01.

From 3. Miami international conference on alternative energy sources; Miami Beach, FL, USA (15 Dec 1980).

A direct coal-fired turbine is a very light engine for powering ships. Weight savings over a diesel engine nearly make up for the added weight associated with fuel bunkering when converting from oil to coal-firing. A method of hot-gas-particulate cleanup based on packed and fluidized rotating beds of Al_2O_3 is discussed as a means of providing adequate turbine blade lifetime. Two cases, a

cargo ship and large merchant tanker are considered. Present value of fuel savings equates to the value of a coal-fired turbine. For a ten-year lifetime, the value of the turbine due to fuel-lost savings is projected to be roughly 48 M$ for the cargo ship and 194 M$ for the tanker.

14278 **(PB—80-173925) Idle fuel consumption in passenger cars. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1975. 11p. NTIS, PC A02/MF A01.

The Environmental Protection Agency has received numerous requests for idle fuel consumption data. The purpose of this report is to provide data which can be used to calculate the energy impact of various actions taken to reduce vehicle time spent at idle. The conclusions drawn from the test data are necessarily of limited applicability. The data base includes only late model vehicles. A complete evaluation of the energy impact of actions taken to reduce vehicle idle time requires more vehicle models and a larger sample of these test vehicles than is included in the data base.

14279 **(PB—80-180730) Transortation projections, 1985, 1995, 2000. Final report.** Woehlcke, C.; Faucett, J.G. (Faucett (Jack) Associates, Inc., Chevy Chase, MD (USA)). Jan 1980. 150p. NTIS PC MF A01.

The report presents projections of transportation activities to 1985, 1995 and 2000 for three economic scenarios. These projections were made using The Department of Transportation (DOT) Long-Range Forecast Model developed for DOT. The transportation activity projections cover the 31 for-hire and private modes of the model. The scenarios are described in terms of economic growth, transportation policies and energy policies. The transportation submodel produces projections of domestic intercity freight flows for 48 commodity groups for all modes expressed in tons, ton-miles, and revenues. The modal split in these projections changes with time and with changes in relative modal costs. An energy efficiency submodel calculates fuel use by each mode in response to changes in fuel prices. Changes in fuel prices are translated into changes in relative modal costs, which affect the modal split for freight. Other changes in relative modal costs may be specified as inputs to the model.

14280 **(PB—80-181951) Prototype planning study, Portland (Oregon). Transportation Systems Management (TSM). Final report.** Spanovich, G. (Metropolitan Service District, Portland, OR (USA)). Nov 1979. 114p. NTIS, PC A06/MF A01.

Transportation System Management (TSM) is a concept that calls for the planning, programming, and implementation of low-capital, short-range improvements designed to increase the efficiency of existing transportation systems. TSM may also serve the goals of energy conservation, environmental protection, and urban revitalization. This report is one of five special studies of the TSM Planning Prototype Studies Program. The program was designed to demonstrate the capabilities of local agencies to undertake TSM planning in a systematic problem oriented manner. This report documents the project in Portland and is designed to provide a summary of the procedures utilized in Portland to systematically develop a regionwide program for TSM delineated on a small area basis. The TSM process includes a statement of goals and objectives, evaluation of existing conditions, a set of proposed action and justification for inclusion of those actions in the area's Transportation Improvement Program.

14281 **(PB—80-187966) Feasibility of recovering useful salts from irrigation wastewater concentrates produced by power plant cooling. Research report.** Sephton, H.H. (California Univ., Berkeley (USA). Sea Water Conversion Lab.). Mar 1980. 45p. NTIS, PC A03/MF A01.

The report evaluates the feasibility of a novel energy-conserving way to recover useful salts (sodium sulfate and calcium sulfate) from concentrated brines by evaporation/crystallization. The concentrated brines examined were cooling tower blowdown from towers using agricultural wastewater as the coolant. This blowdown is further concentrated and used in ion exchange regeneration. Laboratory and pilot tests were made with both conventional evaporation/crystallization and interface-enhanced, vertical-tube foam evaporation which increases evaporation. Sodium sulfate and calcium sulfate recovery provides potential capital cost savings, about $2 million for a 1000-MWe power plant. Sale of these products is an added incentive to their recovery. The use of foamy vapor/liquid flow on the evaporating brine/crystal slurry enhanced heat transfer by up to 40% and enabled concurrent energy reductions of 28%, compared to conventional evaporation/crystallization of sodium sulfate in a 5000-gpd vapor-compression vertical-tube evaporation pilot plant. Consequently, the use of agricultural wastewater for power plant cooling in the San Joaquin Valley with ion exchange for pre-softening and wastewater regeneration solely with concentrated brine from blowdown appears technically feasible and economically attractive.

14282 **(PB—80-188105) Interactions between energy supply and transportation-related energy use. Volume II. Technical appendices. Final report.** Adler, T.J.; Ison, J.W.; Geinzer, J.C. (Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering). Jan 1980. Contract DOT-RC-82003. 228p. NTIS, PC A11/MF A01.

This report describes the structure of ENTRANS and some of its policy analysis applications. ENTRANS is a computer simulation model of the interactions between energy supply and transportation-related energy use. It includes a complete representation of the characteristics of transportation supply (public transit, carpooling, highways, and autos) and of households' travel-related decisions (car type, travel mode, trip length, and frequency choices). The model is capable of analyzing a wide range of policies designed to change automobile fuel use. The results of several detailed policy analyses are described. The report also includes model documentation and a complete user's manual for individuals interested in running ENTRANS.

14283 **(PB—80-190143) Energy management in municipal vehicles.** (Massachusetts Dept. of Community Affairs, Boston (USA)). 1 Mar 1977. 91p. NTIS PC MF A01.

This report describes for the benefit of town managers, selectmen, school officials, and department heads major opportunities for a program of energy conservation. The overview section summarizes for local executives the financial impact of the cost reduction strategies described in each program element.

14284 **(PB—80-190663) State transportation issues and actions. Special report.** Hassell, J.S. Jr.; Kinstlinger, J.; Nickinello, L.R.; Hoch, I.; Fuller, J.W. (Transportation Research Board, Washington, DC (USA)). 1980. 117p. NTIS, PC A06/MF A01.

The Second Conference on Statewide Transportation Planning and Programming, conducted by the Transportation Research Board at the request of the U.S. Department of Transportation and its modal administrations, was held April 29 - May 2, 1979, in Warrenton, Virginia. This report contains the proceedings of the conference. Part 1 summarizes the meeting's highlights. Recommendations by participants are noted in Part 2. Part 3 contains the resource papers prepared for conference participants, along with reports of other presentations made during the meeting. Part 4 summarizes the workshop discussions on the various aspects of implementing statewide transportation plans and on the key elements of such plans. Part 5 lists the participants, who represented various local, state, and federal government agencies; associations; consulting firms; and universities.

14285 **(PB—80-190960) Evaluation of Rolfite Company's gasoline fuel additive 'upgrade'.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Mar 1975. 13p. NTIS, PC A02/MF A01.

The Rolfite Company, of Stamford, Connecticut, first contacted the Emission Control Technology Division (ECTD) in the Spring of 1973 concerning a fuel additive for gasoline which they had developed and were marketing under the name of 'Upgrade'. The additive was evaluated in 1974 by an independent testing laboratory. A test program was conducted following several suggestions from EPA which involved testing a vehicle for emissions and fuel economy at baseline conditions without the additive, at three different mileage points with the additive, and then again without the additive. Results of that program indicated significant pollutant

emission reductions after Upgrade was added to the fuel and about 500 miles had been accumulated on the vehicle with the treated fuel. No significant changes in fuel economy were seen. On the basis of the emission reductions that occurred during the tests, EPA agreed to test the additive. The test program began in December 1974 and ended in March 1975.

14286 **(PB—80-191265) Least-energy operation of river shipping. Volume I: executive summary. Final report Jun 76-Jan 79.** Marbury, F. (Ketron, Inc., Arlington, VA (USA)). 30 Jan 1980. Contract MA-6-38046. 31p. NTIS, PC A03/MF A01.

This study covers the line-haul phase of river shipping. Methods have been derived for determining the best speeds at which to operate river shipping equipment in order to minimize fuel consumption per mile, (or per barge-mile, or per ton-mile), or to minimize line-haul cost per mile, etc. These best speeds depend on equipment propulsive performance and costs, whether bound upstream or downstream, swiftness of current, and depth of water. This methodology will prescribe a best speed for each reach of a river, given the equipment used, its fuel rates, and costs.

14287 **(PB—80-191299) Quantitative effects of acceleration rate on fuel consumption. Technical report.** Jones, R. (Environmental Protection Agency, Ann Arbor, MI (USA)). Apr 1980. 23p. NTIS, PC A02/MF A01.

One factor which has a significant effect on vehicle fuel consumption is the rate at which the vehicle is accelerated. Quantitative and qualitative studies have shown that more rapid and/or more frequent accelerations result in increased fuel consumption. The EPA has conducted a study to quantify the effects of operating a vehicle at different acceleration rates. The test involved accelerating the vehicle at a constant acceleration rate to a speed of 55 mph, and maintaining the 55 mph speed until total distance traveled equaled one mile. Conceptually, this may be viewed as entering a freeway system with different acceleration rates.

14288 **(PB—80-191638) A prospectus for change in the freight railroad industry.** (Department of Transportation, Washington, DC (USA)). Oct 1978. 191p. NTIS, PC A09/MF A01.

The report deals with changes that will be necessary if the railroads are to regain vitality and to continue to play a major role in the Nation's transportation system. The author believes the future holds much promise for the railroads. This traditional transportation technology has been given renewed importance because of the long-term problem of energy availability and the economy's need for efficient transportation to dampen inflationary pressures. The following topics are discussed: industry status; causes of the railroad problem; estimated capital requirements, 1976-1985; restructuring--abandonments, coordination, merger, public ownership; intermodal policy; economic regulation; and alternatives for Federal financial assistance.

14289 **(PB—80-193386) Simulation models for the electric power requirements in an automated guideway transit system. Final report aug 78-Aug 79.** Williams, G.H. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Apr 1980. 137p. NTIS, PC A07/MF A01.

This report describes a computer simulation model developed at the Transportation Systems Center to study the electrical power distribution characteristics of Automated Guideway Transit (AGT) systems. The objective of this simulation effort is to provide a means for determining the power distribution requirements of AGT systems and for evaluating their performances under varied operating conditions. Typical systems which could be modeled include the Morgantown Personal Rapid Transit System, the Dallas-Fort Worth Airtrans System, or one of the proposed Downtown People Movers. This report specifically describes a Fortran computer program which models the electric power requirements of a typical AGT system.

14290 **(PB—80-196082) Effect of acceleration rate on automatic transmission shift-speeds for two 1979 Novas. Technical report.** Jones, R. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jan 1980. 15p. NTIS, PC A02/MF A01.

Variations in acceleration rates will result in variations in vehicle fuel economy. If typical vehicle acceleration rates are distributed in the same manner as the accelerations are distributed on the EPA test cycles, or if the vehicle operational characteristics do not significantly change with acceleration rate, then results from the EPA cycles should be representative of average vehicle use. However, if vehicle operational characteristics change with changing acceleration rates, and if vehicle accelerations in consumer use are not distributed in the same manner as the accelerations of the EPA test cycle, then significant differences between EPA estimated fuel economy and actual vehicle fuel consumption may result. One vehicle characteristic which often changes with acceleration rate is the transmission shift speed for vehicles with automatic transmissions. To determine the effects of acceleration rates on transmission shift speeds, EPA recently conducted a short test sequence on two vehicles with automatic transmissions. These tests determined the relation between vehicle acceleration rate and transmission shift speed for acceleration rates from 1 to 6 mph/sec.

14291 **(PB—80-197791) Vehicle fuel economy: track versus dynamometer. Technical report.** Grugett, B. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1980. 8p. NTIS, PC A02/MF A01.

In a recently completed program a 1979 Chevrolet Nova was operated over EPA driving cycles on a test track at the Transportation Research Center in Ohio and on a chassis dynamometer at the U.S. Environmental Protection Agency's Motor Vehicle Emission Laboratory in Ann Arbor. The data obtained in this program provide an opportunity to compare road and dynamometer fuel economy. This report discusses the results obtained from this program and discusses a dynamometer modification which would make the dynamometer fuel economy a more accurate predictor of fuel economy obtained by the vehicle on the road.

14292 **(PB—80-197908) Operation diesel conservation upgradation of driving and maintenance skills.** (Petroleum Conservation Research Association, New Delhi (India)). 1978. 28p. NTIS, PC A03/MF A01.

A plan is presented which outlines major alternatives for upgrading the skills of diesel vehicle operators and mechanics in India. The primary objective is to realize savings in fuel consumption.

14293 **(PB—80-198344) Least-energy operation of river shipping. volume ii. detailed analyses. Volume III. appendices. Final report June 1976-January 1979.** Marbury, F. (Ketron, Inc., Arlington, VA (USA)). 30 Jan 1980. Contract MA-6-38046. 173p. NTIS, PC A08/MF A01.

This study covers the line-haul phase of river shipping. Methods have been derived for determining the best speeds at which to operate river shipping equipment in order to minimize fuel consumption per mile, (or per barge-mile, or per ton-mile), or to minimize line-haul cost per mile, etc. These best speeds depend on downstream, swiftness of current, and depth of water. This methodology will prescribe a best speed for each reach of a river, given the equipment used, its fuel rates and costs.

14294 **(PB—80-198765) Effect of tire inflation pressure on vehicle fuel economy. Technical report.** Grugett, B. (Environmental Protection Agency, Ann Arbor, MI (USA)). Apr 1980. 17p. NTIS, PC A02/MF A01.

The technical literature indicates that most vehicles on the road are operated with underinflated tires. Since tire energy dissipation increases at lower tire inflation pressure and vehicle fuel consumption increases with increasing tire energy dissipation, a vehicle with underinflated tires will consume more fuel than it would with properly inflated tires. Consequently, a program to increase average tire inflation pressure on in-use vehicles would result in significant fuel savings. The 1977 emission factors program conducted by the U.S. Environmental Protection Agency's Motor Vehicle Emission Laboratory provided an opportunity to gather tire inflation data

from in-use vehicles. This report discusses the analysis of these data and proposes a simple approach to increase tire inflation pressure and reduce U.S. fuel consumption.

14295 **(PB—80-204175) Assessment of national use, choice and future preference toward the automobile and other modes of transportation. Volume I: analysis of motor vehicle ownership and household travel patterns. Part 1: technical report. Final report.** (Cambridge Systematics, Inc., MA (USA)). 1 Jun 1979. Contract NSF-C-PRA77-16108. 360p. NTIS, PC A16/MF A01.

Present and expected future household preferences toward the automobile and other modes of transportation are evaluated in this volume. The factors that influence consumer choices as reflected by current automobile ownership and alternatives to ownership are identified as well as travel patterns of the automobile and other modes of transportation. The analyses are based on a National Transportation Survey of approximately 1,100 households administered as part of this study in June, 1978.

14296 **(PB—80-204183) Assessment of national use, choice and future preference toward the automobile and other modes of transportation. Volume I: analysis of motor vehicle ownership and household travel patterns. Part 2: technical appendices. Final report.** (Cambridge Systematics, Inc., MA (USA)). 1 Jun 1979. Contract NSF-C-PRA77-16108. 105p. NTIS, PC A06/MF A01.

The National Transportation Survey was administered to 1,095 households between mid-May and the end of June, 1978. A national sampling frame was employed to obtain a broad representation of travel behavior. The first section established a complete inventory of the household's motor vehicles, specifying make, model, vintage and options, so that baseline distributions of ownership by vehicle type, size, and weight could be determined. Characteristics of the current and intended uses of the household's motor vehicles were also established.

14297 **(PB—80-204191) Assessment of national use, choice and future preference toward the automobile and other modes of transportation. Volume II: consumer sentiments toward fuel-efficient vehicles. Final report.** (Cambridge Systematics, Inc., MA (USA)). 1 Jun 1979. Contract NSF-C-PRA77-16108. 202p. NTIS, PC A10/MF A01.

Consumer perceptions of the adequacy of energy resources and their corresponding attitudes toward motor vehicle fuel efficiency and driving habits are analyzed in this volume. The data used in the analyses were gathered in a series of nationwide random household surveys conducted between 1973 and 1978.

14298 **(PB—80-204209) Assessment of national use, choice and future preference toward the automobile and other modes of transportation. Volume III: an empirical analysis of household choice among motor vehicles. Final report.** (Cambridge Systematics, Inc., MA (USA)). 1 Jun 1979. Contract NSF-C-PRA77-16108. 67p. NTIS, PC A04/MF A01.

The volume presents an econometric model explaining the make, model, and vintage composition of individual household motor vehicle holdings in order to develop revealed preference estimates of the relative importance of vehicle cost, performance, and size. The empirical analysis is based on a national random sample of households.

14299 **(PB—80-204217) Assessment of national use, choice and future preference toward the automobile and other modes of transportation. Executive summary. Final report.** (Cambridge Systematics, Inc., MA (USA)). Feb 1980. Contract NSF-C-PRA77-16108. 47p. NTIS, PC A03/MF A01.

The document summarizes a final report which presents both a comprehensive evaluation of current nationwide patterns of household motor vehicle ownership and travel behavior, and insights into expected future household travel responses to changes in the demographic, transportation and energy environments.

14300 **(PB—80-204639) Review of procedures for determining corporate average fuel economy. Volume I. Executive summary. Final report, 30 September 1977-31 March 1979.** Rabe, F.T. (EIC, Inc., Newton, MA (USA)). Jul 1979. Contract DOT-HS-7-01771. 21p. NTIS, PC A02/MF A01.

Federal regulations impose financial penalties and credits on automobile manufacturers based upon 0.1 mpg increments in their Corporate Average Fuel Economy (CAFE) values for each model year. CAFE values are defined legally by a set of sampling and estimation procedures that neglect inherent uncertainties. This report characterizes alternative statistical procedures to quantify the inherent uncertainties in average fuel economy and examines their cost-effectiveness in achieving 0.1 mpg precision.

14301 **(PB—80-204647) Review of procedures for determining corporate average fuel economy. Volume II. Technical report. Final report, 30 September 1977-31 March 1979.** Rabe, F.T. (EIC, Inc., Newton, MA (USA)). Jul 1979. Contract DOT-HS-7-01771. 145p. NTIS, PC A07/MF A01.

Federal regulations impose financial penalties and credits on automobile manufacturers based upon 0.1 mpg increments in their Corporate Average Fuel Economy (CAFE) values for each model year. CAFE values are defined legally by a set of sampling and estimation procedures that neglect inherent uncertainties. This report characterizes alternative statistical procedures to quantify the inherent uncertainties in average fuel economy and examines their cost-effectiveness in achieving 0.1 mpg precision.

14302 **(PB—80-209034) Portland Study Element II. I/M effectiveness study. Final report.** Smith, D.A. (Hamilton Test Systems, Inc., Phoenix, AZ (USA)). May 1979. Contract EPA-68-03-2513. 233p. NTIS, PC A11/MF A01.

An exhaust emissions test program was conducted in Portland, Oregon on a sample of privately-owned 1972-77 model year automobiles. The objective of the study was to collect data on the effectiveness of a mandatory vehicle exhaust inspection/maintenance (I/M) program. Cars were recruited from Portland, where they are subject to the Oregon vehicle inspection program, and from Eugene, where they are not. The Eugene cars thus served as the experimental control. The Portland and Eugene fleets were identical in make, model, and model year mix, both representative of the Oregon automobile population of the model years tested. The Portland fleet consisted of equal numbers of cars passing and failing the state inspection when initially recruited. Each car was tested in as-received condition, initially and at 3-month intervals for a year. Portland fail cars were also tested after maintenance. The test sequence included the state idle test, two Federal short tests, the 75 FTP, and the Highway Fuel Economy Test. Complete engine diagnostic checks and owner interviews regarding maintenance were also conducted at each sequence. Emissions and fuel economy data are presented for all tests on every car in the program.

14303 **(PB—80-811722) Recycled materials for roadbuilding. 1970-May, 1980 (citations from the Engineering Index Data Base). Report for 1970-May 80.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 82p. NTIS PC N01/MF N01.

Road construction materials containing solid wastes are researched. Fly ash, mine wastes, glass, and rubber tires are among the candidates selected for recycling. Pavement surfaces and subbases are constructed using these otherwise discarded materials. (Contains 75 citations)

14304 **(PB—80-811730) Recycled materials for roadbuilding. 1964-May, 1980 (citations from the NTIS Data Base). Report for 1964-May 80.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 121p. NTIS PC N01/MF N01.

Road construction materials containing solid wastes are researched. Fly ash, mine wastes, glass, and rubber tires are among the candidates selected for recycling. Pavement surfaces and subbases are constructed using these otherwise discarded materials. (Contains 114 citations)

14305 **(PB—80-812753) Railroad management planning. 1974-June, 1980 (a bibliography with abstracts). Report for 1974-June 1980.** Kenton, E. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 209p. NTIS PC N01/MF N01.

Studies are presented of railroad planning concerning operating costs, yard operations, intermodal systems, railway abandonment and consolidation, efficiency in operations and services, freight car utilization systems, forecasting future railroad freight and passenger market, and the potential of energy conservation in railroad transportation. (This updated bibliography contains 202 abstracts, 46 of which are new entries to the previous edition.)

14306 **(PB—80-812761) Motorcycle safety, environmental effects, and performance studies. 1964-June, 1980 (a bibliography with abstracts). Report for 1964-June 1980.** Kenton, E. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 179p. NTIS PC N01/MF N01.

The reports cited in this bibliography primarily are concerned with motorcycle safety and pollution. These studies cover safety equipment and education, visual and visibility factors, noise, fuel consumption, engine performance, air pollution, vehicle design, tire and brake characteristics, and illuminating systems. Testing programs are described for both machines and operators, underlining impact and anthropomorphic crash data. Training programs are noted for drivers. Particular attention is given to accident prevention, safety helmets, and protective clothing. (This updated bibliography contains 172 abstracts, 37 of which are new entries to the previous edition.)

14307 **(UMTA-IL—06-0034-80-1) Runaround user-side subsidies for mass transportation in Danville, Illinois.** Koffman, D.; Bloomfield, P. (Department of Transportation, Washington, DC (USA). Research and Special Programs Administration). Apr 1980. 365p. NTIS.

This report documents the results of a two-year UMTA Service and Methods Demonstration (SMD) project in Danville, Illinois, testing the application of the user-side subsidy concept to fixed-route transit. Service was provided by private contractors who were selected on a competitive basis every four months. Payment based on the number of prepurchased tickets used by passengers to pay for rides and then turned over to the city was intended to create an incentive for designing and providing good, low-cost service, tailored to the existing demand. The system proved workable. Total costs were comparable to those of similar-size systems operating under more-conventional arrangements, although administrative cost may be higher under the user-side subsidy. Only two providers participated, indicating a lack of effective competition; although, on most routes, good service appears to have been supplied at a reasonable cost. The major provider adopted a very conservative negotiating position with the result that payment was effectively on a fixed-price rather than per-passenger basis.

14308 **(PB—80-174105) Transport and road research, 1978. Annual report.** (Transport and Road Research Lab., Crowthorne (UK)). [nd]. 119p. NTIS, PC A06/MF A01.

Transport planning studies; public passenger transport; rural transport; freight transport; energy and road transport; environmental effects; highway planning, earthworks and underground pipes; road pavement design; road-making materials; construction processes and control; road surface irregularity and riding quality; highway maintenance; tunnel design and construction; bridge design and performance; bridge construction and maintenance; traffic and accident data and analysis; traffic medicine; road design and safety; traffic and safety in urban areas; highway traffic and safety; vehicle design and safety; road safety education and publicity; overseas activities (transport planning, traffic and safety, engineering geology, road user costs, highway engineering, cooperative research in Ghana; advice on road planning and construction; training and information services) are areas discussed.

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REFER ALSO TO CITATION(S) 13320, 13710, 14110, 14129, 14213, 14231, 14232, 14233, 14234, 14235, 14236, 14242, 14243, 14338, 14571, 14572, 14574

14309 **(ANL/CNSV-TM—48) Low-temperature waste-heat recovery in the food and paper industries.** Foell, W.K.; Lund, D.; Mitchell, J.W.; Ray, D.; Stevenson, R.; Ten-Wolde, A. (Wisconsin Univ., Madison (USA); Resource Management Associates, Madison, WI (USA)). Nov 1980. Contract W-31-109-ENG-38. 217p. NTIS, PC A10/MF A01.

The potential of low-temperature waste-heat recovery technology is examined. An examination of barriers to impede waste-heat recovery is made and research programs are identified. Extensive information and data are presented in the following chapters: Waste Heat Recovery in the Wisconsin Food Industry; Waste Heat Recovery in the Wisconsin Pulp and Paper Industry; Industries' Economic Analysis of Energy Conservation Projects; Industrial Waste Heat Recovery (selection of heat-recovery heat exchangers for industrial applications, simplified procedure for selection of heat recovery heat exchangers for industrial applications, selection of heat pumps for industrial applications); Institutional Aspects of Industrial Energy Conservation (economic motivation for energy conservation and the industrial response, intrafirm idea channels and their sources, evaluation and approval of plant improvement projects, reported barriers to adopting waste heat recovery projects and recommendations for government involvement, and the final chapter is a summary with major conclusions given. Additional information is given in two appendices on the potential waste heat recovery in a cheese plant (calculation) and conditions for optimum exchanger size and break-even fuel cost. (MCW)

14310 **(ANL/CNSV-TM—51) State industrial energy-conservation workshops.** Murphy, P.T.; Tatar, J.J.; Evans, A.R.; Anderson, R.W. (Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 44p. NTIS, PC A03/MF A01.

DOE's Office of Industrial Programs, in cooperation with the Office of State and Local Programs, sponsored a series of four workshops on state industrial energy-conservation programs in September and October, 1980. The workshops provided it a forum in which Federal and state officials could discuss: Federal programs supporting the development and implementation of industrial energy-conservation technology; Federal assistance available for state and local energy-conservation programs; states' programs and policy efforts to encourage industrial energy conservation, and identification of states' needs and recommendations for actions to meet the states' needs more effectively. The basic focus of the workshops was on industrial programs developed by the states through funding by the State Energy-Conservation Program. The objectives, background, and format of the workshops are described in Section 2. A summary of state industrial programs in Section 3 includes a program measure matrix and a discussion of elements in program design. Section 4 describes factors affecting the development, implementation, and evaluation of state industrial conservation programs. In Section 5 state needs, as perceived by the state representatives, are presented and discussed. Section 6 summarizes the states' suggestions as developed in the third session of each workshop.

14311 **(DOE/CH/10026—1) Energy conservation in the primary aluminum and chlor-alkali industries.** (Hittman Associates, Inc., Columbia, MD (USA)). Oct 1980. Contract AC02-80CH10026. 63p. NTIS, PC A04/MF A01.

The primary aluminum and chlor-alkali industries together use nearly 13% of the electrical energy consumed by US industry. As part of its mission to promote energy conservation in basic US industries, the DOE surveys the present technological status of the major electrochemical industries and evaluates promising technological innovations that may lead to reduced energy requirements. This study provides technical and economic analyses in support of a government program of research and development in advanced electrolytic technology. This program is intended to supplement the development efforts directed toward energy savings by private industry. Sections II and III of this report cover aluminum and chlo-

rine production processes only, since these two industries represent over 90% of the electrical energy requirements of all electrolytic industries in the United States. Section IV examines barriers to accelerated research and development by the electrolytic industries, and makes suggestions for government actions to overcome these barriers.

14312 **(DOE/CS/20346—T3) Preliminary assessment of anticipated availability and utilization of independent test laboratories to support certification and enforcement of DOE's Energy-Efficiency Standards Program.** (Vitro Labs., Silver Spring, MD (USA)). 13 Feb 1981. Contract AC01-78CS20346. 37p. NTIS, PC A03/MF A01.

The DOE Conservation Program for Consumer Products requires the testing of products to determine whether they meet applicable energy-efficiency standards. Certification testing will take place at the manufacturers' facilities, while monitoring and enforcement usually take place at or by an independent test laboratory (ITL). Specifically, monitoring will take place at ITLs except in the case of trade-association programs where testing is generally conducted by trade-association representatives. ITLs will be utilized by DOE for all enforcement testing. Monitoring- and enforcement-test requirements are provided in Sections 2 and 3. Estimates and associated analysis of existing ITL capacity are given in Section 4. Section 5 compares ITL capacity and projected test-facility requirements and examines the cost and difficulty of eliminating projected deficits. A summary and conclusions are presented in Section 6. Appendix A presents an analysis of the sensitivity of projected ITL requirements to changes in key variables.

14313 **(DOE/CS/20346—T5) Small manufacturer concerns.** (Vitro Labs., Silver Spring, MD (USA)). 4 Aug 1981. Contract AC01-78CS20346. 39p. NTIS, PC A03/MF A01.

Visits were made to 4 small manufacturers to ascertain the potential impacts on small consumer-product manufacturers of the certification and enforcement portions of DOE's energy-efficiency-standards program. Particular concern was expressed about the possible need for large capital investments in new test facilities in which to perform the tests and the extent to which manufacturer test facilities and technical staff may be diverted from necessary research and development and quality-control activities. Subsequent to the visits, several requirements were added to the proposed rule for the retention of units of covered basic models, involving such actions as retaining the certification batch sample for various times and measured efficiencies. Discussions and results of the visits are presented in the appendices.

14314 **(DOE/CS/20346—T6) Implementation procedures for the certification and enforcement of DOE energy-efficiency standards.** (Vitro Labs., Silver Spring, MD (USA)). 9 Jun 1980. Contract AC01-78CS20346. 183p. NTIS, PC A09/MF A01.

The Preamble of the Certification/Enforcement of the DOE Energy Efficiency Standards is presented. Definitions of certification and enforcement are first presented. Additional parts are: Major Certification/Enforcement Approaches Considered; Proposed Certification/Enforcement Approach; Sample Plan for Certification and Enforcement Testing; Estimated Manufacturer Test Costs Under the Proposed Approach; and Additional Certification/Enforcement Issues (relationship between DOE Enforcement of Standards and Industry Trade Association Programs; test variability among different test facilities; small-manufacturer concerns). Complete procedures of the Certification/Enforcement Program are given. Important information given in the appendices are: sampling-plan requirements for certification and enforcement testing; required information and format for the certification report, conditional certification report, and post-certification report; required information and format for the pre-certification report; minimum information to be retained by the manufacturer on energy-efficiency test facilities and instrumentation; and list of minimum supporting certification test data to be retained by the manufacturer.

14315 **(DOE/CS/40081—T2) Development and demonstration of energy-conserving drying modifications to textile processes. Part II, Phase III. Final report, December 1, 1978-November 30, 1979.** Brookstein, D.S.; Carr, W.W.; Holcombe, W.D. (Georgia Inst. of Tech., Atlanta (USA). School of Textile Engineering). 1980. Contract AS05-76CS40081. 133p. NTIS, PC A07/MF A01.

Research was conducted to develop and to expand procedural and engineering modifications to textile drying processes in order to reduce energy requirements. Research was concentrated on: an investigation of the potential of a Machnozzle as a fabric predrying device and a program to optimize textile can drying with respect to energy consumption. Results demonstrated that the Machnozzle can significantly reduce the moisture content in fabric. The energy consumption of the Machnozzle compares favorably with that for steam can drying. An economic analysis of the Machnozzle as a predrying device was made using the Internal Rate of Return. Results showed that the economic feasibility of using the Machnozzle was dependent on the cost of energy and process operating conditions. (MCW)

14316 **(DOE/CS/40132—T1) Assessment of energy requirements in proven and new copper processes.** Pitt, C.H.; Wadsworth, M.E. (Utah Univ., Salt Lake City (USA). Dept. of Metallurgy and Metallurgical Engineering). 31 Dec 1980. Contract AS07-78CS40132. 376p. NTIS, PC A17/MF A01.

Energy requirements are presented for 13 pyrometallurgical and 8 hydrometallurgical processes for the production of copper. Front end processing, mining, mineral processing, gas cleaning, and acid plant as well as mass balances are included. Conventional reverberatory smelting is used as a basis for comparison. Recommendations for needed process research in copper production are presented.

14317 **(EGG-CS—5328) Potential industrial applications for direct contact waste heat recuperator systems. Final report.** Semler, T.T.; Hansen, E.J.; Richlen, S.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Feb 1981. Contract AC07-76ID01570. 216p. NTIS, PC A10/MF A01.

A study of the potential industrial applications of direct contact waste heat recuperator systems has been conducted. This study examines the prospects for the use of direct contact waste heat recuperator systems in the major energy consuming industries excluding only the petroleum and chemical industries. Four potential applications have been chosen for economic analysis. They are: (a) stack gas from diesel electric generation, (b) boiler stack gas, (c) waste heat stream from the hydraulic cement dry process dryer, and (d) stack gas from the fire polishing of glass. The waste heat streams studied ranged from 175 to 750°F. A physical analogue of the direct contact waste heat recuperator system has been devised and used for costing purposes. Payback calculations are performed for these applications. Only the stack gas from the fire polishing of glass failed to show significant economic promise. A waste heat stream regime of greater than 10,000 cfm and between 400 and 750°F has been identified as most economically promising for direct contact waste heat recuperation and hot process water delivery.

14318 **(NP—25300) Electric Utility Rate Design Study: lessons in load management.** (National Economic Research Associates, Inc., Los Angeles, CA (USA)). 25 Jun 1980. 106p. EPRI, Palo Alto, CA.

A dozen utilities' attempts to plan, adopt, and evaluate various load-management techniques are described briefly. These range from time-of-day pricing for large industrial customers to the direct control by radio of residential water heaters. The kinds of utilities surveyed encompass very large privately owned multi-company systems as well as small-sized municipally operated companies. The examples include winners and losers. Uncertainty both before and after testing pervades most of the experiments. In some cases, switches or recorders worked and in other cases they did not. Two commonsense lessons stand out: (1) it takes two or three years to plan and conduct a load-management test of even the smallest size; and (2) although experimental results are often quite modest, most seem favorable given a wide spectrum of objectives. Another

lesson, although there are exceptions, is that data can be collected faster than utilities can analyze the information. Often the data and analysis are such that firm conclusions are difficult to draw. Overall, it appears that utilities take rather-small first steps but are willing to increase their commitments over time. Even though the peak-shaving and load-shifting effects, in the short run, are small, the results appear beneficial.

14319 **(PB—80-173115) Solid waste energy and resource recovery study for Hennepin County, Minnesota. Executive summary.** Pope, R.I.; Ombruni, P.R. (Henningson, Durham and Richardson, Minneapolis, MN (USA)). Nov 1975. 17p. NTIS, PC A02/MF A01.

Results are reported from a study to determine the technical and economic feasibility of energy and resource recovery from solid waste in Hennepin County, Minn. Residential, commercial, and industrial waste generation rates were established on a per capita and per employee basis, and processable waste generation in tons per week was determined. The composition of the waste was evaluated for recoverable materials and also for energy. Reliable markets were identified for ferrous and aluminum metals, but because of uncontrollable influences on supply and markets, recovery of glass, paper, and cardboard was deemed questionable. Potential fuel markets were evaluated for supplemental fuel, steam, pyrolysis gas, and pyrolysis oil. The recommended energy recovery facility is a central steam plant near the Minneapolis central business district. The potential cost savings for the county through the proposed system is about $6 million per year in 1980 and $8 million per year in 1990. Hospital and health care wastes, automated waste collection systems, and environmental studies were undertaken. With special precautions, hospital and health care wastes could be accommodated at a resource recovery facility. Automated solid waste collection in the area analyzed was less economical than conventional truck collection. There will be no significant adverse environmental effects from the project, and there are several significant environmental benefits. The report has been submitted to the County Board of Commissioners, and decisions on implementation will be made by the Board after public review and response. Tabular and graphic data are provided.

14320 **(PB—80-179294) Demolition wastes: data collection and separation studies. Final report.** Wilson, D.G.; Davidson, T.A.; Ng, H.T.S. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Mechanical Engineering). Dec 1979. 250p. NTIS PC E07/MF $4.50.

Data on the principal materials contained in demolition wastes have been collected from many cities and towns across the United States. Such information can serve as a basis for establishing policy for demolition and for assisting private industry in planning, particularly with respect to improved treatment. The program comprised the following: (1) extension of previous data collection to include a larger number of cities and small communities; (2) development of a predictive model for demolition-waste generation in any year; (3) collection of the size characteristics of 'raw' demolition debris; and (4) examination of the economic and engineering feasibility of central reclamation plants for demolition wastes. The study indicates that the quantity of demolition wastes varies widely from year to year but averaged 34 million tons in the mid-seventies. Major components by mass are concrete, wood, and brick, of which only the last is reused in large amounts. Size characteristics of larger demolition pieces were calculated by stereoscopic photography. No combination of indicators is accurate in correlating or predicting the flow of demolition wastes. Economic prospects of a central recycling plant were examined. The report recommends best current practices and needed developments for advanced machinery in demolition and materials reclamation.

14321 **(PB—80-180920) Management of summer-seasonal irrigation water in beef cow/calf agriculture in the Sierra Nevada foothills. Technical completion report.** Raguse, C.A.; Williams, W.A. (California Univ., Davis (USA). Water Resources Center). Mar 1980. 10p. NTIS, PC A02/MF A01.

Efficient agricultural production in the Sierra Nevada foothills is generally achieved only through the use of the grazing animal. Economically this region has a comparative advantage, for the production of beef calves, over regions of intensive agriculture. Grazing is also an appropriate biological tool for land management in the nonagricultural interests of the general public. Use of seasonally available irrigation water for perennial and annual forages was evaluated in terms of biological yield and economic feasibility.

14322 **(PB—80-182140) The use of the climatic water budget in irrigation scheduling: Iowa. Report No. 2.** Mather, J.R.; DeNardo, A. (Delaware Univ., Newark (USA). Water Resources Center). Jul 1978. 33p. NTIS, PC A03/MF A01.

Scheduling the correct amount of supplemental irrigation is a problem facing all irrigators. While various techniques have been developed to permit calculation of time and amount of irrigation needs, most are so complex or require so many data that they cannot be evaluated by the individual farmer or irrigation operator. A simplified irrigation scheduling procedure using average information on the climatic demand for water (evapotranspiration) and the precipitation as measured at the particular irrigation site is described.

14323 **(PB—80-182579) Energy and US agriculture: 1974 and 1978.** Torgerson, D.; Cooper, H. (Economics, Statistics, and Cooperatives Service, Washington, DC (USA). National Economics Div.). Apr 1980. 120p. NTIS, PC A06/MF A01.

Agricultural production used approximately 8.5 billion gallons of liquified fuel in 1978. This was up from the nearly 8 billion gallons in 1974. Fuel oil and liquified petroleum (LP) gas usage remained relatively constant between 1974 and 1978. The most dramatic changes were in diesel and gasoline usage. Gasoline use dropped about 0.2 billion gallons and diesel fuel use increased almost 0.7 billion gallons, accounting for the net 0.5 billion gallon increase in liquid fuel usage. On farm business use of natural gas and electricity showed virtually no change between 1974 and 1978.

14324 **(PB—80-193584) Bottoming cycle cogeneration: prospects and problems. Consultant report (final).** Montgomery, H. (Montgomery (Hugh), Santa Monica, CA (USA)). May 1980. 48p. NTIS, PC A03/MF A01.

The study was undertaken to determine the potential for, and identify the problems standing in the way of, wider application of bottoming cycle cogeneration. There is significant potential for use of bottoming cycle cogeneration in California industry, since tens of billions of Btus/hr are being exhausted to the atmosphere in the form of waste heat with temperatures in excess of 700F, much of it at substantially higher temperatures. If all of this exhaust heat were used to generate electricity, the amount could be in the order of 1,000 MW.

14325 **(PB—80-193592) Cotton gin trash incinerator-air heat project. Consultant report (final).** (Pitt (Norman), Inc., Montebello, CA (USA). Agrotherm Div.). May 1980. 39p. NTIS, PC A03/MF A01.

The California Energy Commission has funded the final phase of a four year project resulting in development of a successful system for burning cotton gin trash as a fuel providing the heat for ginning. The incinerator - air heater system installed in Corcoran, California operates continuously throughout the ginning season. Trash feeding and burning rate is automatically controlled from the combustion temperature, hot air temperature is controlled by the drying needs, and ashes are automatically removed from the system and pneumatically conveyed to the disposal site. The system complies with state and county air pollution codes by means of baghouse collectors. Savings in fossil fuel and trash disposal costs have demonstrated the equipment system is feasible for a four year payback at large, well utilized gins.

14326 **(PB—80-196793) Demonstration of beneficial uses of warm water from condensers of electric generating plants. Final report, May 1975-April 1980.** Boyd, L.L.; Ashley, G.C.; Hietala, J.S.; Stansfield, R.V.; Tonkinson, T.R.C. (Northern States Power Co., Minneapolis, MN (USA)). May 1980. 75p. NTIS, PC A04/MF A01.

The report gives results of a project to demonstrate that warmed cooling water from condensers of electric generating plants can effectively and economically heat greenhouses. The 0.2-hectare demonstration greenhouse, at Northern States Power Co.'s

Sherburne County (Sherco) Generating Plant, used 29.4 C water to heat both air and soil: finned-tube commercial heat exchangers were used to heat the air; and buried plastic pipes, the soil. Warm water from the Sherco 1 cooling tower was piped over 0.8 km to the greenhouse where it was cooled from 2.7 to 5.6 C before returning to the cooling tower basin. Roses and tomatoes were the principal crops in the 3-year test, although other flowers and vegetables, and conifer seedlings were also grown. The warm water heating system supplied all the greenhouse heating requirements, even at ambient temperatures as low as -40 C. Roses, snapdragons, geraniums, tomatoes, lettuce, and evergreen seedlings were grown successfully.

14327 **(PB—80-197882) Replacement of inefficient boilers by modern package boilers for fuel economy.** (Petroleum Conservation Research Association, New Delhi (India)). 1979. 33p. NTIS, PC A03/MF A01.

A survey has revealed that a saving of 10% to 20% in fuel oil consumption, in the majority of India's industrial boiler installations, could be realized through replacement of existing boilers with modern package boilers. An assessment is made of the investment needs and savings potential for modernization of oil fired boilers throughout the country. Constraints inhibiting modernization are identified and remedial measures are suggested.

14328 **(PB—80-812910) Energy conservation: industry. 1964-June, 1980 (citations from the ntis data base). Report for 1964-June, 1980.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 345p. NTIS PC N01/MF N01.

Potential methods of conserving energy, including fuel and materials substitutions, are considered for various industries. Many abstracts deal with reports that also cover processes used, amount of energy consumed, and environmental considerations of energy conserving options. Industries covered include food, paper, chemical, cement, metals, petroleum refining, contract construction, synthetic rubber, plastics, drug manufacturing, and stone, clay, and glass. Energy conservation through the use of waste heat is covered in a related Published Search entitled Waste Heat Utilization. (This updated bibliography contains 335 citations, 37 of which are new entries to the previous edition.)

14329 **Waste heat utilization with annual aquifer storage.** Schaetzle, W.J.; LeCroy, J.E.; Seppanen, M.S.; Brett, C.E. (Univ. of Alabama, University). *Transactions of the American Nuclear Society ;* **34**: 16(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14330 **Industrial waste heat for community heating systems.** Van Ornum, J.; Huxtable, D.D. (Rocket Research Co., Redmond, WA). *Transactions of the American Nuclear Society ;* **34**: 13-15(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

3206 Municipalities And Community Systems

14331 **(ANL/CNSV-TM—52) PORST: a computer code to analyze the performance of retrofitted steam turbines.** Lee, C.; Hwang, I.T. (Argonne National Lab., IL (USA)). Sep 1980. Contract W-31-109-ENG-38. 34p. NTIS, PC A03/MF A01.

The computer code PORST was developed to analyze the performance of a retrofitted steam turbine that is converted from a single generating to a cogenerating unit for purposes of district heating. Two retrofit schemes are considered: one converts a condensing turbine to a backpressure unit; the other allows the crossover extraction of steam between turbine cylinders. The code can analyze the performance of a turbine operating at: (1) valve-wide-open condition before retrofit, (2) partial load before retrofit, (3) valve-wide-open after retrofit, and (4) partial load after retrofit.

14332 **(ANL/CNSV-TM—53) Evaluation and recommendations for the Department of Energy-Farmers Home Administration small-town energy-planning grant program.** Cannon, T.; Kron, N. Jr. (Argonne National Lab., IL (USA)). Oct 1980. Contract W-31-109-ENG-38. 109p. NTIS, PC A06/MF A01.

DOE funded several small-town energy planning projects, through the Farmer's Home Administration (FmHA) Area Development Assistance Planning Grant Program. DOE intended that this program should: (1) encourage community energy planning and the development of Integrated Community Energy Systems (ICES) and (2) provide a testing ground for the technologies and planning methods developed by its Buildings and Community Systems Division. FmHA intended that the joint program should further the development of rural areas and make DOE expertise available to grant recipients doing energy planning. All grantees under this joint program endeavored to define their local energy problems and to find local solutions. However, the resulting energy cost savings were not always impressive, and generally they were not very well documented. Lack of implementation power, lack of focus, and inability to generate local financial support for projects and further planning were the main reasons for this performance. The lack of sufficient documentation could be the result of DOE's failure to require a standardized and systematic accounting of grantees' accomplishments. The recommended changes in the scope-of-work requirements suggested in this report would cause grantees to focus their energy-planning activities so as to increase local financial support. The appendixes give a standardized format by which grantees would account for the energy savings and production made possible by their planning efforts.

14333 **(ORNL/TM—6830/P11) District heating/cogeneration application studies for the Minneapolis-St. Paul area. Impact of a district heating/cogeneration system on annual average SO_2 air quality in the twin cities.** Karnitz, M.A.; Kornegay, F.C.; McLain, H.A.; Murphy, B.D.; Raridon, R.J.; Schlatter, E.C. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 109p. NTIS, PC E05/MF $3.50.

Includes 6 sheets of 24 reduction microfiche.

A study was made to determine the potential impact of a district-heating/cogeneration system on the air quality in the Minneapolis-St. Paul metropolitan area. Annual average SO_2 concentrations in air at ground level were determined for a base year (1976) and for a future year (1987) with and without a 2600-MW(t) district-heating system. Without district heating, the SO_2 concentrations in the area are predicted to increase with time because of anticipated increased substitution of oil for curtailed natural gas. Implementation of the district-heating/cogeneration system is predicted to mitigate this increase of SO_2 concentrations significantly. Although the total emissions will be slightly higher with district heating/cogeneration because of the substitution of coal for natural gas and oil, use of tall stacks at the cogeneration plants will permit greater dispersion of the SO_2 emissions. Considerable overall energy savings, particularly in the form of natural gas and oil, will be realized with a district heating/cogeneration system.

14334 **(PB—80-175540) Energy conservation in urban development plan.** Boos, B.; Nordfeldt, G. (Swedish Council for Building Research, Stockholm). 1980. 99p. NTIS, PC A05/MF A01.

The report describes the consequences of different effects from a practical application of alternative low-energy systems in connection with the planning of new residential areas.

14335 **(PB—80-178924) Deposit and bounty systems for controlling the discard of durable goods and hazardous items in post-consumer waste flows.** Ginberg, P. (Meta Systems, Inc., Cambridge, MA (USA)). Nov 1978. 104p. NTIS, PC A06/MF A01.

This report is a study of the use of deposit-refund and bounty systems to help control the flow of durable goods and hazardous items in post-consumer waste flows. Under such systems, the refund or bounty is used to induce individual consumers to conform to a desired waste control practice. This study examines the objectives and effects of deposit-refund and bounty systems and dis-

cusses the major design issues that must be resolved in order to implement these systems. Ten different products or product groups are examined with respect to the probable effects of using a deposit-refund or bounty system.

14336 **(PB—80-178973) Evaluation of Community Services Administration (CSA) Emergency Energy Conservation Services Program; subsidiary topics: health, accessibility, employment, housing, mobility.** (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). Oct 1978. 36p. NTIS, PC A03/MF A01.

This report reviews and analyzes the impact of Community Services Administration's (CSA's) Emergency Energy Conservation Services Program in health improvement resulting from weatherization, in access to fuel supplies for the poor, in employment resulting directly or indirectly from energy program expenditures, in housing stability or the ability of clients to remain in their current residences, and in mobility and access to transportation.

14337 **(PB—80-182694) Small-scale and low-technology resource recovery study. Final report.** Mitchell, G.L.; Peterson, C.; Bowring, E.R.; West, B. (SCS Engineers, Inc., Reston, VA (USA)). Dec 1979. 266p. NTIS, PC A12/MF A01.

A study was conducted to assess the applicability of various approaches to resource recovery to selected waste generators. The resource recovery systems and technologies were limited to those operating in the small-scale range, defined as less than 100 tons per day input, or those approaches considered to be low technology, defined as having more than 50 percent of operation and maintenance costs associated with labor, i.e., labor intensive. The generators included institutions, commercial sources, office building complexes, multi-unit residences and small cities.

14338 **(PB—80-186513) Development of a state hazardous waste management system: planning, ownership options, liability and management technologies.** Steeler, J.H.; Lazarus, G.H. (National Conference of State Legislatures, Denver, CO (USA)). Feb 1979. 74p. NTIS, PC A04/MF A01.

The report is the first in a series concerning the development of hazardous waste management capabilities. Economic, technical, and legal aspects of the service component of a hazardous waste management system are examined to provide information to legislators and legislative staff in these areas and to identify future needs. The following issues are addressed: planning methodologies; ownership options; requirements for liability and financial responsibility; management technologies; resource conservation and recovery; and treatment and disposal technology. Tables and charts in the appendices provide a summary of resource and energy recovery potential for hazardous wastes in New York State; unit processes for resource recovery; an estimated magnitude of hazardous wastes from selected industries that are potentially recoverable or recyclable; the distribution of hazardous waste recovery operations in the United States; and unit identification for recovery, treatment, disposal and containment processes.

14339 **(PB—80-190812) Alaska village demonstration projects. Final report.** Reid, B.H. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). Mar 1980. 63p. NTIS, PC A04/MF A01.

Two demonstration projects were built as authorized by Section 113 of PL 92-500. Modular construction was used to provide central utility systems which included water supply, laundry, bathing, saunas, and wastewater treatment. Service to homes was by vehicular delivery. Fire destroyed the facility at Wainwright in 1973 and the project was subsequently rebuilt. Energy conservation measures were employed to minimize costs of operation. Equipment performed satisfactorily, but operator preparedness was lacking, thus, many breakdowns occurred. Overall cost of operation and maintenance of the facilities nearly exceed the financial capacity of the communities. Ownership of the facilities was transferred to the local government by the EPA. The AVDP was paralleled by projects built by the Alaska Department of Environmental Conservation (ADEC) at 11 locations. Small communities need outside support for operation and maintenance of utility systems. Time and training will be required to prepare local residents to assume managerial responsibilities for these projects.

14340 **(PB—80-193980) Waterborne trash recycling plant study. Volume I: executive summary. Final report September 78-May 80.** Halebsky, M.; Herrington, J.; Schaff, J.; Woodyard, J.; West, B. (Global Marine Development, Inc., Newport Beach, CA (USA)). May 1980. Contract DO-A01-78-3081. 24p. NTIS, PC A02/MF A01.

The feasibility of waterborne trash recycling and energy recovery facilities was investigated for combinations of three locations and four processes. The three locations were Seattle, Washington (sheltered bay site); San Diego, California (open ocean); and St. Louis, Missouri (pierside). The four processes were production of coarse refuse-derived fuel (RDF); compressed fluff RDF; low Btu gas via the PUROX pyrolysis process; and electric power. Ferrous metal was also recovered from the waste.

14341 **(PB—80-193998) Waterborne trash recycling plant study. Volume II: detailed study. Final report, September 1978-May 1980.** Halebsky, M.; Herrington, J.; Schaff, J.; Woodyard, J.; West, B. (Global Marine Development, Inc., Newport Beach, CA (USA)). May 1980. Contract DO-A01-78-3081. 154p. NTIS, PC A08/MF A01.

The feasibility of waterborne trash recycling and energy recovery facilities was investigated for combinations of three locations and four processes. The three locations were Seattle, Washington (sheltered bay site); San Diego, California (open ocean); and St. Louis, Missouri (pierside). The four processes were production of coarse refuse-derived fuel (RDF); compressed fluff RDF; low Btu gas via the PUROX pyrolysis process; and electric power. Ferrous metal was also recovered from the waste.

14342 **(PB—80-194004) Waterborne trash recycling plant study. volume iii: appendices. Final report, September 1978-May 1980.** Halebsky, M.; Herrington, J.; Schaff, J.; Woodyard, J.; West, B. (Global Marine Development, Inc., Newport Beach, CA (USA)). May 1980. Contract DO-A01-78-3081. 89p. NTIS, PC A05/MF A01.

The feasibility of waterborne trash recycling and energy recovery facilities was investigated for combinations of three locations and four processes. The three locations were Seattle, Washington (sheltered bay site); San Diego, California (open ocean); and St. Louis, Missouri (pierside). The four processes were production of coarse refuse-derived fuel (RDF); compressed fluff RDF; low Btu gas via the PUROX pyrolysis process; and electric power. Ferrous metal was also recovered from the waste.

14343 **(PB—80-196090) Office of Conservation (Seattle, Washington): 1979 annual report.** Patton, S.; Murray, R.H. (Seattle City Light Dept., WA (USA). Office of Conservation). 1979. 46p. NTIS, PC A03/MF A01.

This report reviews Seattle City Light Conservation Program activities.

14344 **Seasonal Thermal Energy Storage Program.** Minor, J.E. (Battelle Northwest Labs., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 13(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14345 **Economic study of district heating using existing culinary water supply systems.** Pitts, D.R. (Clemson Univ., SC); Looper, M.G.; Schmitt, R.C. *Transactions of the American Nuclear Society ;* **34**: 15-16(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14346 **New town center 58°N.** Fullerton, A. pp 312-316 of Proceedings of the national passive solar conference, 4th, 1979. Franta, G. (ed.). Newark, DE; International Solar Energy Society Inc. (1979).

From 4. national passive solar energy conference; Kansas City, KS, USA (3 Oct 1979).

This paper describes the feasibility of constructing a carless, pneumatic, sun bowled structure to serve as Town Center and transition community for a new town of approximately 12,500 people. Food production, organic and solid waste recycling, recreational,

educational, commercial, governmental and cultural facilities could be integrated.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 14183, 14292

14347 **(PB—80-197890) Educational campaign for petroleum and fuel conservation.** (Petroleum Conservation Research Association, New Delhi (India)). 1979. 25p. NTIS, PC A02/MF A01.

The report discusses the desirability of and strategies for a campaign to encourage conservation among individual consumers of petroleum products in India. Topics covered include the potential for conservation in the unorganized consumers sector; selection of suitable messages; selection of media for the campaign; costs of achieving a desired coverage and ways of minimizing these costs; ensuring maximum effectiveness; efforts in various other countries.

14348 **(PB—80-207251) Building a library for energy and appropriate technology.** Reynolds, L.J. (Syracuse Research Corp., NY (USA). Energy Research Center). Dec 1979. 22p. NTIS, PC A02/MF A01.

The report is one in a series of bulletins to provide technical assistance to administrators of programs to weatherize the homes of poor persons.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

14349 **(ANL/CNSV-TM—49) Environmental development plan for transportation programs: FY80 update.** Saricks, C.L.; Singh, M.K.; Bernard, M.J. III; Bevilacqua, O.M. (Argonne National Lab., IL (USA)). Sep 1980. Contract W-31-109-ENG-38. 139p. NTIS, PC A07/MF A01.

This is the second annual update of the environmental development plan (EDP) for transportation programs. It has been prepared as a cooperative effort of the Assistant Secretaries for Conservation and Solar Energy (ASCS) Office of Transportation Programs (CS/TP) and the Environment (ASEV) Office of Environmental Assessments. EDPs identify the ecosystem, resource, physical environment, health, safety, socioeconomic, and environmental control concerns associated with DOE programs. The programs include the research, development, demonstration, and assessment (RDD and A) of 14 transportation technologies and several strategy implementation projects. This EDP update presents a research and assessment plan for resolving any potentially adverse environmental concerns arising from these programs. The EDP process provides a framework for: incorporating environmental concerns into CS/TP planning and decision processes early to ensure they are assigned the same importance as technological, fiscal, and institutional concerns in decision making; resolving environmental concerns concurrently with energy technology and strategy development; and providing a research schedule that mitigates adverse environmental effects through sound technological design or policy analysis. This EDP also describes the status of each environmental concern and the plan for its resolution. Much of ongoing DOE reseirch and technology development is aimed at resolving concerns identified in this EDP. Each EDP is intended to be so comprehensive that no concerns escape notice. Care is taken to include any CS/TP action that may eventually require an Environmental Impact Statement. Because technology demonstration and commercialization tend to raise more environmental concerns than other portions of the transportation program, most of this EDP addresses these concerns.

3301 Internal Combustion Engines

14350 **(AD-A—087838) Advanced technology components for model GTP305-2 aircraft auxiliary power system. Final report 6 May 75-15 Jul 79.** Kidwell, J.R.; Large, G.D. (AiResearch Mfg. Co., Phoenix, AZ (USA)). Feb 1980. 541p. NTIS, MF A01.

The GTP305-2 Advanced APU is a single shaft, all shaft power engine incorporating an axial-centrifugal compressor, a reverse flow annular combustor and a radial-axial turbine. Cycle analyses indicated a 10-percent high pressure compressor flow increase improved matching characteristics with the low pressure compressor. The combustion system is a reverse flow annular combustor with an air-assist/airblast fuel injection system. The radial-axial turbine stage is characterized by an integrally cast turbine rotor and a cast exhaust duct assembly. The Integrated Components Assembly (ICA) rig consists of the combustor and turbines with a dummy mass on the shaft to simulate the compressor. ICA testing was conducted to establish component performance at design operating conditions. ICA and cold air aerodynamic testing of the turbine stage and cooling flow effects, indicates design efficiency goals were exceeded. ICA test results, cold-air testing and combustion system parameters were input to the cycle model. Room temperature strain-control LCF tests were performed and results analyzed on a Weibull distribution. Data analysis indicated LCF life improvement was obtained through HIP and heat treatment.

14351 **(PB—80-175490) Evaluation of a Nissan Fast Burn Engine System (NAPS-Z). Technical report.** Kranig, J.M. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jan 1980. 48p. NTIS, PC A03/MF A01.

The EPA is interested in new technological developments which will reduce exhaust emissions and improve fuel economy. Because the development of the Fast Burn Engine System (NAPS-Z) by the Nissan Motor Company, Ltd., appeared to be a new technological development, the EPA requested a vehicle for testing and evaluation at the Motor Vehicle Emission Laboratory in Ann Arbor. Nissan Motor Company, Ltd., agreed to provide a vehicle for evaluation and agreed that the test program would include a variety of test conditions to enable a complete evaluation of the vehicle characteristics. The engine concept is the result of development aimed at meeting 0.41, 3.4 and 1.0 grams per mile for HC, CO, and NOx, respectively, while improving fuel economy. The conclusions from the EPA evaluation of the NAPS-Z can be considered to be quantitatively valid only for the vehicle used. However, it is reasonable to extrapolate the results from the EPA test program to other vehicles in a directional manner. It is reasonable to suggest that similar results are likely to be achieved where a similar engine concept is applied to other types of vehicles.

14352 **(PB—80-175714) The effect of ignition timing modifications on emissions and fuel economy. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Oct 1975. 28p. NTIS, PC A03/MF A01.

The Emission Control Technology Division of the Environmental Protection Agency is interested in engine control techniques that influence emissions and fuel economy. One engine parameter that is readily adjustable is basic ignition timing, and it was desired that data be collected on a variety of late model (1975) vehicles to quantify its effect. Data from such a program would be useful in studies of inventor devices which occasionally include timing adjustments as part of the installation instructions, in tampering studies where investigations are made of the effect of emission control system modification, and in octane requirement problem investigations because of the influence of ignition timing on octane requirements.

14353 **(PB—80-178999) EPA-Volkswagen light duty diesel correlation study, 1979. Correlation report.** Scarbro, C. (Environmental Protection Agency, Ann Arbor, MI (USA). Engineering Operation Div.). 1980. 31p. NTIS, PC A03/MF A01.

In response to a meeting with representatives of Volkswagen on September 14, 1979, a correlation study was organized to characterize some of the factors causing hydrocarbon offsets during the 1980 diesel certification program. (Volkswagen read 40% lower hydrocarbon emissions than EPA). The hypothesis presented at this time by Volkswagen were: (1) offsets do not occur because of sample line variations from lab to lab and (2) offsets are caused by diesel fuel composition differences between EPA's fuel and Volkswagen-Wolfsburg's fuel. These two hypotheses were tested in two separate experiments at EPA as part of the correlation study. In November, Volkswagen brought two vehicles to the United States

and requested EPA to do a series of six Hot LA-4s on each vehicle at the EPA facility. This report is the summary of the three different studies performed in cooperation with EPA plus the results of independent Volkswagen cooling fan experiments. These studies included similar vehicles and facilities, but addressed different correlation cause/effect relationships.

14354 **(PB—80-181985) Evaluation of Analube synthetic lubricant. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1974. 6p. NTIS, PC A02/MF A01.

The Environmental Lubricants Company of New Britain, Connecticut, contacted the Office of Air and Water Programs to request a laboratory and engineering evaluation of their polyglycol base synthetic lubricant. Supplied with the request was a test report indicating significant reductions of exhaust emissions and fuel economy improvement. A confirmatory test program was conducted by the Technology Assessment and Evaluation Branch of the Emission Control Technology Division. Analube is a synthetic lubricant formulated from a polyglycol base with a molybdenum compound for lubricity. This synthetic lubricant is marketed as a replacement for the normal hydrocarbon motor oils. There was no cost information provided by the manufacturer.

14355 **(PB—80-187339) Evaluation of a M-151 jeep and two 1973 Ford Capris powered by 141 CID PROCO stratified charge engines. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1975. 40p. NTIS, PC A03/MF A01.

The Programmed Combustion Process (PROCO) or 'stratified charge' engine concept has been under development at the Ford Motor Company since 1958. Under contracts with the United States Army Tank-Automotive Command initiated in December of 1967, Ford converted ten L-141 military utility truck engines to PROCO. Four of these engines were installed in M-151 jeeps which were tested for emissions and durability. Another four engines were used in dynamometer testing. At the conclusion of the Army program, the Environmental Protection Agency contracted to have three of the latter four engines installed in 1973 Ford Capris. The purpose was to evaluate the PROCO engine in a vehicle more representative of typical passenger cars than the military jeep. This report covers the testing of number three of the four military jeeps, and preliminary testing of two of the Capris. Also included are results of non-regulated emission tests conducted on one of the PROCO Capris and a standard 2.0 litre Capri at Southwest Research Institute.

14356 **(PB—80-189640) Study of exhaust emissions from twenty high mileage Oldsmobile diesel passenger cars. Technical report.** White III, J.T.; Jones, G.T. (Environmental Protection Agency, Ann Arbor, MI (USA)). Mar 1980. 24p. NTIS, PC A02/MF A01.

This paper describes the results of an exhaust emission testing program conducted by EPA on twenty diesel-powered Oldsmobile passenger cars. Each was a full-size 1978 model equipped with the 350 CID engine. The primary purpose of this program was to assess the emission durability of this engine which was originally designed to operate on gasoline. Secondary objectives included an evaluation of fuel economy, measurement of particulate emissions and gathering of samples for subsequent Ames Test analyses.

14357 **(PB—80-191034) Potential of spark ignition engine, 1979 summary source document. Final report.** Trella, T.; Zub, R.; Colello, R. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Mar 1980. 208p. NTIS, PC A10/MF A01.

This report provides an assessment of the potential for spark ignition engines passenger cars and light trucks. The assessment includes: tradeoffs between fuel economy and emissions; improvements in spark ignition engine efficiency; improvements in engine parasitics; improvements due to transmissions; effect of aerodynamic drag and tire rolling resistance on fuel economy; effect on performance and fuel economy of weight and axle ratio; lubricant improvements; impact of fuels; and noise considerations.

14358 **(PB—80-191836) Potential of spark ignition engine, effect of vehicle design variables on top speed, performance, and fuel economy. Final report.** Zub, R.W.; Neckyfarow, C.M.; Lew, W.M.; Colello, R.G. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Mar 1980. 86p. NTIS, PC A05/MF A01.

The purpose of this report is to evaluate the effect of vehicle characteristics on vehicle performance and fuel economy. The studies were performed using the VEHSIM (vehicle simulation) program at the Transportation Systems Center. The computer simulation offers repeatability and can predict minute changes in fuel economy based on relatively small vehicle alterations. The degree to which each vehicle parameter is modified is based upon projections presented in current literature. The results are assessed and an explanation of the interaction of the vehicle design characteristics on performance is presented.

14359 **(PB—80-192685) Potential of diesel engine, emission technology. Final report Jan-Jul 79.** Sturm, J.; Trella, T. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Mar 1980. 47p. NTIS, PC A03/MF A01.

This report surveys diesel engine emission technologies applicable to passenger cars and light trucks. The general design and operating features are presented and discussed. Current and state-of-the-art concepts are reviewed with the focus on control of diesel emissions through (1) modification of the combustion process, (2) aftertreatment systems and (3) fuel modifications.

14360 **(PB—80-193659) Potential of diesel engine, 1979 summary source document. Final report.** Trella, T. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Mar 1980. 166p. NTIS, PC A08/MF A01.

This document assesses the fuel economy potential of diesel engines in future passenger cars and light trucks. The primary technologies evaluated include: (1) engine control strategy and implementation, (2) the engine design variables, (3) emissions and noise, (4) fuels, (5) lubricants, (6) vehicle-engine matching, and (7) the effects of vehicle characteristics. The major findings are summarized.

14361 **(PB—80-195746) Potential of diesel engine, diesel engine design concepts, control strategy and implementation. Final report.** Trella, T.; Shen, T. (Department of Transportation, Cambridge, MA (USA). Transportation Systems Center). Mar 1980. 61p. NTIS, PC A04/MF A01.

Diesel engine design concepts and control system strategies are surveyed with application to passenger cars and light trucks. The objective of the study is to indicate the fuel economy potential of the technologies investigated. The engine design parameters discussed are related to the engine configuration, combustion process, valving, friction, compression ratio, and heat transfer. Various engine control strategies and control implementation are considered.

14362 **(PB—80-197098) Potential of diesel engines, fuels and lubrication technology. Final report.** Cornetti, G. (Fiat Centro Richerche, Turin (Italy)). Mar 1980. Contract DOT-TSC-1424. 62p. NTIS, PC A04/MF A01.

The chemical and physical properties of diesel fuel are reviewed along with their relationships to the fuel economy and emissions of diesel powered automobiles and light trucks. The fuels considered include both conventional and alternative diesel fuels. Additives are surveyed and their impacts on combustion and overall engine performance are discussed. The fuel economy potential of future lubricants is investigated, particularly (1) upgraded mineral oils, (2) synthetic oils, and (3) colloidal suspension in mineral oils.

14363 **(PB—80-199185) Electronic engine controls - availability, durability, and fuel economy effects on 1983 and later model year light-duty trucks. Technical report.** Nugent, T.; Diatchun, Z.; Cox, T. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1980. 19p. NTIS, PC A02/MF A01.

The application of microprocessor technology to optimize the functions of the internal combustion engine is underway. Pas-

senger car model years 1980 and 1981 have seen the widespread introduction of electronic engine controls of varying degrees of complexity. These controls hold the promise of lowering engine emissions and raising engine fuel economy through the optimization of the combustion processes at all engine operational conditions. This paper examines the potential of this technology for use in the future light-duty truck fleet. The implications of this technology on fleet fuel economy, in conjunction with the more stringent emission standards in 1983, are examined along with projections as to the future availability and durability of these microprocessors and their associated engine sensors.

14364 **Future trends in subsonic transport energy efficiency turbofan engines.** Johnston, R.P.; Ortiz, P. (GE, Cincinnati, Ohio). *American Society of Mechanical Engineers, [Paper]*; No. 80-GT-177, 1-10(1980).

Details of the NASA sponsored General Electric Energy Efficient Engine technology program are presented along with a description of the engine, cycle and aircraft system benefits. Opportunities for further performance improvement are examined. Studies leading to the selection of the cycle and configuration are summarized. 7 refs.

3302 External Combustion Engines

14365 **(DOE/NASA/0032—81/9) Automotive Stirling Engine Development Program. Quarterly technical progress report for period June 29-October 3, 1980.** (Mechanical Technology, Inc., Latham, NY (USA). Stirling Engine Systems Div.). Dec 1980. Contract AI01-77CS51040. 75p. (NASA-CR—165194). NTIS, PC A04/MF A01.

Current information on component and subsystems development activities and engine and vehicle testing during July to October 1980 in the Automotive Stirling Engine Development Program is reported. Computer code development progress is also covered. The status of the manufacture of the Mod I is given in some detail. Program engine operating hours through the end of this quarterly period reach a total of 6181 h.

14366 **(DOE/NASA/51040—21) Four-cylinder Stirling engine controls model.** Lorenzo, C.F.; Daniele, C.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1980. Contract AI01-77CS51040. 24p. (NASA-TM—81648; CONF-801182—1). NTIS, PC A02/MF A01.

From Automotive technology development contractor coordination meeting; Dearborn, MI, USA (11 Nov 1980).

A four working space, double-acting piston, Stirling engine simulation is being developed for controls studies. The development method is to construct two simulations, one for detailed fluid behavior, and a second model with simple fluid behaviour but containing the four working space aspects and engine inertias, validate these models separately, then upgrade the four working space model by incorporating the detailed fluid behavior model for all four working spaces. The single working space (SWS) model contains the detailed fluid dynamics. It has seven control volumes in which continuity, energy, and pressure loss effects are simulated. Comparison of the SWS model with experimental data shows reasonable agreement in net power versus speed characteristics for various mean pressure levels in the working space. The four working space (FWS) model was built to observe the behavior of the whole engine. The drive dynamics and vehicle inertia effects are simulated. To reduce calculation time, only three volumes are used in each working space and the gas temperatures are fixed (no energy equation). Comparison of the FWS model predicted power with experimental data shows reasonable agreement. Since all four working spaces are simulated, the unique capabilities of the model are exercised to look at working fluid supply transients, short circuit transients, and piston ring leakage effects. The FWS model has been upgraded by using the detailed SWS model for each of the four working spaces. Currently the detailed FWS model is being reworked to reduce the amount of calculation time per cycle.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 14093, 14138

14367 **(ANL/CNSV—13) Environmental Assessment of the US Department of Energy Electric and Hybrid Vehicle Program.** Singh, M.K.; Bernard, M.J. III; Walsh, R.F. (Argonne National Lab., IL (USA)). Nov 1980. Contract W-31-109-ENG-38. 526p. NTIS, PC A23/MF A01.

This environmental assessment (EA) focuses on the long-term (1985-2000) impacts of the US Department of Energy (DOE) electric and hybrid vehicle (EHV) program. This program has been designed to accelerate the development of EHVs and to demonstrate their commercial feasibility as required by the Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976 (P.L. 94-413), as amended (P.L. 95-238). The overall goal of the program is the commercialization of: (1) electric vehicles (EVs) acceptable to broad segments of the personal and commercial vehicle markets, (2) hybrid vehicles (HVs) with range capabilities comparable to those of conventional vehicles (CVs), and (3) advanced EHVs completely competitive with CVs with respect to both cost and performance. Five major EHV projects have been established by DOE: market demonstration, vehicle evaluation and improvement, electric vehicle commercialization, hybrid vehicle commercialization, and advanced vehicle development. Conclusions are made as to the effects of EV and HV commercialization on the: consumption and importation of raw materials; petroleum and total energy consumption; ecosystems impact from the time of obtaining raw material through vehicle use and materials recycling; environmental impacts on air and water quality, land use, and noise; health and safety aspects; and socio-economic factors. (LCL)

14368 **(DOE/ET/25420—T1) Life-cycle energy analyses of electric vehicle storage batteries. Final report.** Sullivan, D.; Morse, T.; Patel, P.; Patel, S.; Bondar, J.; Taylor, L. (Hittman Associates, Inc., Columbia, MD (USA)). Dec 1980. Contract AC02-79ET25420. 291p. NTIS, PC A13/MF A01.

The results of several life-cycle energy analyses of prospective electric vehicle batteries are presented. The batteries analyzed were: Nickel-zinc; Lead-acid; Nickel-iron; Zinc-chlorine; Sodium-sulfur (glass electrolyte); Sodium-sulfur (ceramic electrolyte); Lithium-metal sulfide; and Aluminum-air. A life-cycle energy analysis consists of evaluating the energy use of all phases of the battery's life, including the energy to build it, operate it, and any credits that may result from recycling of the materials in it. The analysis is based on the determination of three major energy components in the battery life cycle: Investment energy, i.e., The energy used to produce raw materials and to manufacture the battery; operational energy i.e., The energy consumed by the battery during its operational life. In the case of an electric vehicle battery, this energy is the energy required (as delivered to the vehicle's charging circuit) to power the vehicle for 100,000 miles; and recycling credit, i.e., The energy that could be saved from the recycling of battery materials into new raw materials. The value of the life-cycle analysis approach is that it includes the various penalties and credits associated with battery production and recycling, which enables a more accurate determination of the system's ability to reduce the consumption of scarce fuels. The analysis of the life-cycle energy requirements consists of identifying the materials from which each battery is made, evaluating the energy needed to produce these materials, evaluating the operational energy requirements, and evaluating the amount of materials that could be recycled and the energy that would be saved through recycling. Detailed descriptions of battery component materials, the energy requirements for battery production, and credits for recycling, and the operational energy for an electric vehicle, and the procedures used to determine it are discussed.

14369 **(EPRI-EM—1723) EPRI-SCE testing and evaluation of electric vehicles: Lucas van and Jet 007, 750, and 1400. Annual report.** (Southern California Edison Co., Rosemead (USA)). Feb 1981. 78p. NTIS, PC A05/MF A01.

This report describes the second phase of the EPRI-SCE Electric Vehicle Project, in which four additional electric vehicles (EVs) were tested and evaluated: the Jet Industries Model 007 pas-

senger car, Model 750 pickup truck, and Model 1400 passenger van; and the Lucas-Bedford Model CFE cargo van. During the first phase of this project, four EVs were also tested: Jet 500, Volkswagen Type 2, DAUG Type GM2, and Battronic Minivan. The project emphasizes road-testing of vehicles to acquire data on their useful driving range, performance, reliability, and driver acceptance in utility-fleet use. Each vehicle was driven more than 100 miles along SCE-selected test routes to determine the effects of different terrains (level, slight grades, and steep grades), traffic conditions (one-, two-, three-, and four-stops/mile and freeway), and payload. The vehicle component failures that occurred during testing are itemized and described briefly, and assessments are made of expected field reliability. Other vehicle characteristics and measurements of interest are presented. The data base on these test vehicles is intended to provide the reader an overview of the real world performance that can be expected from present-day state-of-the-art EVs.

14370 **(PB—80-189111) Performance of the electrosport electric vehicle. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1974. 21p. NTIS, PC A02/MF A01.

The Electric Fuel Propulsion (EFP) Company of Ferndale, Michigan, has been converting conventionally powered vehicles to electric power. EFP does the required design work, fabricates system components as necessary and installs the system in a vehicle. The Special Vehicle Program Branch of the Advanced Automotive Power Systems Development Division contracted with EFP for the use of a prototype vehicle to evaluate its performance. The test of the vehicle reported herein was conducted over a one-year period from August 1972 to July 1973.

14371 **Nickel/zinc battery: a promising candidate for electric vehicle propulsion.** Yao, N.P.; Miller, J.F.T. (Argonne Natl Lab, Ill). pp 871-884 of American Institute of Metallurgical Engineers meeting. Warrendale, PA; Metallurgical Society of AIME (1980).

From American Institute of Metallurgical Engineers meeting; Las Vegas, NV, USA (Feb 1980).

A rechargeable nickel/zinc battery is one of the three near-term candidates, along with improved lead-acid and nickel/iron batteries, which are under development for electric and hybrid vehicles application. The nickel/zinc battery has the highest specific energy and specific power, but its cycle life falls short of acceptable levels. This paper addresses the development status of nickel/zinc battery technology. Battery materials requirements, especially nickel and zinc, are projected in the light of a unit manufacturable battery and electric vehicle market scenarios. 13 refs.

14372 **(UCRL—53092) Comparison of future battery systems for application to general-purpose electric vehicles.** O'Connell, L.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). Aug 1980. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01.

The results are presented of a study to compare the aluminium/air battery as a general purpose automobile power source with those secondary batteries evaluated in a four year study entitled Energy Storage Systems for Automobile Propulsion. The results of this study were published in three interim reports, one each in 1977, 1978 and 1979. The final report is being published in 1980. The aluminum/air battery had not developed early enough to be included in the evaluation. Recent progress on this battery makes it important to compare it on a vehicle system basis to other possible future batteries. The analysis techniques used in the comparison were the same as for the four-year study.

3304 Hybrid Systems

14373 **(LA-UR—81-373) Fuel cells for automotive applications: overview.** McCormick, J.B. (Los Alamos National Lab., NM (USA)). 1980. Contract W-7405-ENG-36. 15p. (CONF-801242—2). NTIS, PC A02/MF A01.

From Electric and hybrid vehicle advanced technology seminar; Pasadena, CA, USA (8 Dec 1980).

Projections are made of fuel cell technology for vehicular use. The fuel used to provide hydrogen to a phosphoric acid fuel cell is assumed to be methanol. Experimental performance data for a golf cart is discussed. The design, economics, and predicted performance for a fuel cell retrofitted x-car with lead-acid batteries for peaking power, are described. The technical and economic feasibility of using fuel cells in city buses, vans and passenger cars are examined. It is concluded that the fuel cell/battery hybrid vehicle will have the advantages of high efficiency, i.e., 53% improvement in fuel economy, long fuel cell life, performance comparable to IC engine vehicles, low maintenance, petroleum fuel conservation, low pollution, and quiet operation. From a comparison of the lifetime costs of conventional vehicles versus fuel cell vehicles, it is concluded that commercialization of fuel cells for buses is most feasible followed by van and automobile applications. (LCL)

3305 Flywheel Propulsion

REFER ALSO TO CITATION(S) 14092, 14093, 14101, 14373

14374 (CONF-801128—, pp 315-323) **Flywheel/heat engine vehicle design and analysis.** Beachley, N.H.; Frank, A.A. (Univ. of Wisconsin, Madison). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

The research program at the University of Wisconsin which has been aimed at the design and construction of a second-generation flywheel automobile is summarized. One of the principal goals is to demonstrate 50 mpg over the Federal Urban Driving Cycle with a 3000-lb car. Designs have been developed for several CVT's that would be suitable for the experimental car, including ways of packaging the various systems within the engine compartment of the X-body GM automobile. Specifications have been written for the required performance and efficiency characteristics of the CVT. Control-system principles have been developed with the aid of real-time hybrid computer simulations. A four-square dynamometer for testing CVT's has been designed and built. Tests are in progress for determining CVT efficiency and control characteristics. Safety flywheel concepts have been developed.

14375 (CONF-801128—, pp 324-327) **Flywheel: heat engine vehicle.** Kalns, I. (Eaton Corp., Southfield, MI). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Work in an initial phase of a larger program whose goal is to successfully demonstrate Mechanical Energy Storage Technology (MEST) potential for energy savings in vehicular systems is summarized. The initial phase comprises a study of promising system arrangements, the selection of one for further analysis, and its preliminary design.

14376 **(LA—8722-MS) Preliminary assessment of the impact of flywheel energy storage technology on taxicab fleet operation in a large metropolitan city.** Krupka, M.C.; Jackson, S.V. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 61p. NTIS, PC A04/MF A01.

The incorporation of flywheel energy storage systems (FESS) into automotive vehicles has been under consideration for some time. Previous studies have suggested that FESS can yield substantial benefits in automotive vehicle operation, particularly for urban driving. This study describes a preliminary assessment of the impacts resulting from incorporation of FESS into automotive fleets in a large metropolitan city. Specifically, the case of taxicab fleet operation within New York City is examined. Unique features of taxicab fleets and taxicab operational characteristics within New York City are described. A levelized life-cycle cost comparison between a standard internal combustion engine vehicle (ICEV) in present use as a taxicab in NY and a projected FESS/ICEV taxicab has been generated. Potential energy-savings and environmental benefits are discussed, and potential institutional barriers to FESS implementation are identified. The levelized life-cycle cost comparison suggests that: FESS/ICEV costs are 3.3 cent/paid mile less than that of the ICEV; the capital costs represent a small fraction of the total and are less than fuel costs in both categories; and the cost of driving and dispatch is the major cost in both categories. Sensitivity studies performed on several parameters emphasize the value of FESS in taxicab operation in New York City. An assumed

50% increase in fuel economy (miles/gallon) translates to a 33.3% savings in fuel purchase for the same annual accumulated mileage by New York City licensed taxicabs. For ~ 12,000 vehicles at $1.20/gallon, annual savings amount to ~ $30 x 10^6 (~ 25 x 10^6 gallons). Environmental improvement in the form of reduction emissions is to be expected with the introduction of FESS/ICEV taxicabs.

14377 **(PB—80-175300) Flywheel energy management systems for improving the fuel economy of motor vehicles. Final report, 30 Jun 1976-30 Jun 1977.** Beachley, N.H.; Frank, A.A. (Wisconsin Univ., Madison (USA). Engineering Experiment Station). Aug 1979. 194p. NTIS, PC A09/MF A01.

The goals of the research program have been: (1) to develop, analyze and compare CVT designs to minimize the friction losses and weight of an integrated flywheel powerplant package, (2) to provide preliminary designs of flywheel propulsion systems for automobiles and minibuses, (3) to study the economic feasibility of production, (4) to obtain additional operational experience and experimental data on the research flywheel vehicle built at the University. The experimental flywheel vehicle has demonstrated 32 mpg over the EPA-CVS Federal Urban Driving Cycle at an inertia weight of 2750 lb. Calculations based on experimental engine data indicate that federally-mandated emissions levels could be achieved with little degradation in fuel economy. The computer simulation programs developed have been verified by experiment.

3306 Vehicle Design Factors

14378 (CONF-801128—, pp 328-339) **Regenerative braking through elastomeric energy storage.** Hoppie, L.O.; Speranza, D.; Nowell, G.C. (Eaton, Corp., Southfield, MI). 1980.

From Mechanical, magnetic, underground energy storage contractors review; Washington, DC, USA (10 Nov 1980).

Results of tests on full-size elastomers designed around two different stressing schemes are presented. A fatigue life problem due to abrasion was uncovered while testing the first design, and tests are underway to determine whether or not the second scheme will exhibit a fatigue life problem. Also presented is the most promising torque control concept for a complete elastomeric regenerative braking system.

14379 **(PB—80-173867) Evaluation of an automobile power and deceleration governor. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Apr 1974. 6p. NTIS, PC A02/MF A01.

The Power and Deceleration Governor is a vacuum controlled throttle valve assembly installed between the carburetor and the engine intake manifold. The control mechanism of the device affects a carburetion cut-off during deceleration and limits throttling during acceleration. There are no parameter changes made to the engine's basic spark timing, idle CO setting, or idle rpm.

14380 **(PB—80-178981) Implementation analysis of brake inspectability requirements. Final report.** Cross, A.L.; Wakeley, W.; Viergutz, O.J.; Harvey, M. (IIT Research Inst., Chicago, IL (USA)). Dec 1979. 80p. NTIS, PC A05/MF A01.

An accurate description of the feasibility, optimum schedule, and cost of implementing a brake inspectability requirement for all production passenger cars (PPC) and light trucks (LT) was prepared. The work was performed as a part of Task 1h Manufacturing and Maintainability, which addresses the need for supporting fuel conservation through vehicle design. The study made use of best available data on PPC and LT current and projected production designs and data, real and predicted costs of production, and expert engineering judgement, to predict the impact of separate inspection requirements and the overall consequences of implementation for improvement of fuel economy.

3307 Emission Control

REFER ALSO TO CITATION(S) 13837, 14351, 14352, 14353, 14354, 14355, 14356, 14357, 14359, 14712

14381 **(PB—80-170657) Evaluation of the Ram-Jet device, a PCV air bleed. Technical report.** Barth, E.A. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jan 1980. 14p. NTIS, PC A02/MF A01.

The Environmental Protection Agency receives information about many systems which appear to offer potential for emission reduction or fuel economy improvement compared to conventional engines and vehicles. This report discusses EPA's evaluation of the Ram-Jet, a retrofit device marketed by Ed Almquist. It is designed to bleed in extra air to the engine by allowing ambient air to bypass the carburetor under high engine load conditions. The manufacturer claims the device reduces emission pollutants and improves fuel economy.

14382 **(PB—80-173776) Effect of ambient temperature on vehicle emissions and performance factors. Appendix A: test results for all vehicles. Appendix B: plots of exhaust gas catalyst out temperatures. Final report.** Spindt, R.S.; Dizak, R.E.; Stewart, R.M.; Meyer, W.A.P. (Gulf Research and Development Co., Chestwick, PA (USA)). Sep 1979. 500p. NTIS, PC A21/MF A01.

Ambient temperatures have been reported to affect automotive emissions and fuel economies since 1966. Federal automobile emission standards and the measured fuel economies are currently based on results obtained using the 1975 Federal Test Procedure and the Highway Fuel Economy Test. Both tests must be conducted at ambient temperatures from 68F (20C) to 86F (30C). Since cars in service must start and run over a much broader temperature range than this, the U.S. Environmental Protection Agency wanted to know how well the various car age groups and emission control technologies available today would perform at the more extreme ambient temperatures using the above test procedures as well as other specialized tests. It was also desired to know how the use of a car's air conditioner would affect exhaust emissions and fuel economies. This report presents the results of exhaust emissions (regulated and unregulated) and fuel economies associated with fourteen selected vehicles tested at ambient temperatures ranging from 0 deg F (-18C) to 110F (43C) using the various test procedures.

14383 **(PB—80-173784) Effect of ambient temperature on vehicle emissions and performance factors. Appendix C: gas chromatographic results. Final report.** Spindt, R.S.; Dizak, R.E.; Stewart, R.M.; Meyer, W.A.P. (Gulf Research and Development Co., Chestwick, PA (USA)). Sep 1979. 824p. NTIS, PC A99/MF A01.

This report presents the results of exhaust emissions (regulated and unregulated) and fuel economies associated with fourteen selected vehicles tested at ambient temperatures ranging from 0F (-18C) to 110F (43C) using the various test procedures. This Appendix gives the gas chromatographic results obtained in this program.

14384 **(PB—80-175581) Analysis of propane gain used as a screen on the Portland Element III sample. Technical report.** Brzezinski, D. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Mar 1980. 10p. NTIS, PC A02/MF A01.

Propane gain values have been collected from 292 Portland Element III (1975-77 model year) vehicles along with as-received FTP and idle test emission measurements. This data is used here to compare the expected failure rate, errors of commission, and the amount of FTP excess emissions identified if one of two sets of idle values or one of four propane gain values had been used as a cut-point to screen the vehicles in the sample with high emissions.

14385 **(PB—80-175938) Emissions from aircraft fuel nozzle flames. Final report.** Tuttle, J.H.; Shisler, R.A.; Bilger, R.W.; Mellor, A.M. (Purdue Univ., Lafayette, IN (USA). Combustion Lab.). Jul 1975. 150p. NTIS, PC A07/MF A01.

Experimental emissions data from both internal flame and exhaust plane gathered in a simulated gas turbine primary zone at

typical combustor operating conditions are analyzed in terms of the developed time parameters. Results indicate that, with a well atomized fuel spray, the large scale turbulent mixing controls the flame stoichiometry and hence the emissions characteristics. However as the fuel atomization becomes poorer, the flame structure is altered and emissions characteristics can be explained only by a combination of heterogeneous and homogeneous processes. Because CO and NOx emissions originate in separate regions of the flame, it was possible to alter the turbulent mixing properties of each region such that both CO and NOx were reduced.

14386 **(PB—80-176191) Evaluation of the Owens-Illinois toroidal ceramic reactor. Technical report.** Gompf, H.L. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1972. 6p. NTIS, PC A02/MF A01.

Representatives of Owens-Illinois, Inc. contacted the Test and Evaluation Branch of the Environmental Protection Agency to request a brief evaluation of a vehicle equipped with ceramic toroidal reactors of their design. As reactors of this type will be evaluated in the studies being conducted by NASA on ceramic reactors, a test program was initiated. This report describes the test program and presents the test results and conclusions.

14387 **(PB—80-177272) An evaluation of the Lamkin device. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1974. 6p. NTIS, PC A02/MF A01.

Mr. Cliff Lamkin contacted the Environmental Protection Agency's Emission Control Technology Division concerning an invention of his which allegedly reduced exhaust emissions and improved fuel economy. He supplied data from an independent laboratory on tests conducted with and without the device installed on a motor vehicle which indicated a marked reduction in emissions with the device installed. He was invited to the Motor Vehicle Emission Laboratory for confirmatory testing during the week of April 22, 1974. The Lamkin device did not improve emissions or fuel economy as much as reducing the idle CO did. Mr. Lamkin indicated that he had not tried his device on a newer, leaner-running car. Mr. Lamkin's invention was a modification to the stock carburetor using an unconventional fuel metering system.

14388 **(PB—80-179146) Recommended practice for determining exhaust emissions from heavy-duty vehicles under transient conditions. Technical report.** France, C.J.; Clemmens, W.; Wysor, T. (Environmental Protection Agency, Ann Arbor, MI (USA)). Feb 1979. 84p. NTIS, PC A05/MF A01.

This recommended practice represents the completion of one phase of EPA's transient cycle development effort. The finalized chassis procedures detailed here parallel the engine test procedures recently published as subpart N of the Heavy-Duty Notice of Proposed Rulemaking (NPRM). The engine test will remain for EPA the primary means of determining transient heavy-duty emissions; however, the chassis test will be available when total-vehicle testing is desired (for example, for a radically new engine design, for in-use programs, or perhaps for future durability testing on in-service vehicles). This report contains a bibliography of EPA technical reports and contract reports which document various aspects of the chassis driving cycle and engine cycles' development.

14389 **(PB—80-180474) Motor vehicle emission inspection/maintenance information kit. Final report.** (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Sep 1978. 144p. NTIS, PC A07/MF A01.

Transportation-related air pollution continues to poison the air we breathe. In the nation's urban areas almost all of the carbon monoxide, about half of the hydrocarbons, and somewhat less than half of the nitrogen oxides (the latter two helping to form photochemical oxidants or smog) come from mobile sources. Inspection/maintenance complements the national effort to control motor vehicle emissions. The Clean Air Act Amendments of 1977 set forth specific requirements for the implementation of motor vehicle inspection/maintenance (I/M) programs. This report contains a policy paper indicating what the Environmental Protection Agency will consider a minimally acceptable program wherever I/M is required by the Act. Also included are sections detailing the benefits, costs, legislation, training and implementation of I/M programs.

14390 **(PB—80-180664) Investigation into hydrogen sulfide odor problem on a privately-owned, catalytic converter-equipped 1975 automobile. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1975. 8p. NTIS, PC A02/MF A01.

The Michigan-Ohio District Office of the Environmental Protection Agency was contacted in April, 1975 by a person living in the Cleveland, Ohio area about the unpleasant odor emanating from his brand-new 1975 catalytic converter-equipped Plymouth Gran Fury. The odor had been noticeable from the time the owner took delivery of the car, and was at its worst when the car was idling or moving in dense traffic, according to the owner. Along with the unpleasant odor, irritations of the throat and nose were experienced by the owner and his family. District Office personnel contacted the Emission Control Technology Division for technical advice on the problem. The owner was invited to bring his car to the Motor Vehicle Emission Laboratory (MVEL) for a thorough investigation. This report covers that investigation, which took place in early June, 1975.

14391 **(PB—80-181860) Evaluation of the National Clean Air Coalition (NCAC) dual catalyst Pinto. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1975. 11p. NTIS, PC A02/MF A01.

The National Clean Air Coalition (NCAC), a non-profit environmental organization, contacted the Environmental Protection Agency about a prototype emission control system they had developed and had operating on a 1974 Ford Pinto. The system was aimed at emission levels of .41 grams per mile hydrocarbons (HC), 3.4 grams per mile carbon monoxide (CO), and .4 grams per mile oxides of nitrogen (NOx). Confirmatory testing at the EPA laboratory was requested, and the Emission Control Technology Division agreed to conduct an evaluation test program as part of its continual technology assessment function. The EPA receives information about many systems which appear to offer potential for emission reduction or fuel economy improvement. In those cases in which review by EPA technical staff suggests that the data available shows promise, attempts are made to schedule tests at the EPA Emissions Laboratory. The results of all such test programs are set forth in a series of Technology Assessment and Evaluation Reports, of which this report is one.

14392 **(PB—80-181969) The contribution of heavy-duty vehicles to the New York City emission inventory. Technical report.** Platte, L. (Environmental Protection Agency, Ann Arbor, MI (USA)). Feb 1980. 18p. NTIS, PC A02/MF A01.

The EPA Administrator signed a regulation setting standards for hydrocarbons (HC) at 1.3 g/BHP-hr and carbon monoxide (CO) at 15.5 g/BHP-hr for 1984 and later model year heavy duty vehicles (HDV). The reduction in the total emission levels due to the introduction of these standards was estimated on a national level by combining the emission inventories of several regions. These regions represent most of the major metropolitan areas in the U.S. that have violations of the national ambient air quality standards (NAAQS) for ozone and CO. This combined inventory may account for a large proportion of the total U.S. population subjected to the high pollutant levels, but it may not be the appropriate inventory for demonstrating the maximum emission reduction achievable through the introduction of the new standards. The inventory of an area characterized by a high traffic density with a large number of HDV should be examined to approximate the maximum reduction in total emissions that can be attributed to the new HDV standards. In an effort to approximate this maximum reduction, the HC and CO inventories for the New York City (NYC) area are examined in this report.

14393 **(PB—80-190655) Effects of gasohol on idle HC and CO emissions. Technical report.** Darlington, T.; Lawrence, R. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Mar 1980. 19p. NTIS, PC A02/MF A01.

A test program was run to investigate the effects of gasohol on CO and HC emissions on an I/M idle test. Three vehicles were

set up to operate on either gasoline or gasohol. A Hamilton emissions analyzer was used to measure tailpipe emissions. CO emissions were varied in each of the cars by adjusting the idle mixture screw, and HC emissions were varied by inducing a misfire with a misfire generator. At each CO and HC value as specified in the program, the fuel was switched from gasoline to gasohol while its effect was noted on tailpipe emissions. The data obtained provided a basis for determining gasohol's ability to reduce CO and HC emissions for an idle test.

14394 **(PB—80-190952) Evaluation of the econo-mist device.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Mar 1975. 13p. NTIS, PC A02/MF A01.

The Emission Control Technology Division (ECTD) was contacted by the General Services Administration (GSA) concerning a vapor injection device for use with automobile engines. The device is called the Econo-Mist and is a product of the FAP Corporation of Albuquerque, New Mexico. GSA had received information that the Econo-Mist reduced hydrocarbon and carbon monoxide emissions and increased fuel economy. At the request of GSA, ECTD agreed to test the device. A sample of the device was brought to the EPA laboratory in Ann Arbor, Michigan by FAP Corporation personnel on January 13, 1975.

14395 **(PB—80-192701) Potential of spark ignition engine, electronic engine and transmission control. Final report January-July 1978.** Garofalo, F.J. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Mar 1980. Contract DOT-TSC-1046. 105p. NTIS, PC A06/MF A01.

This report identifies, evaluates, and documents the characteristics and functions of significant electronic engine and powertrain control systems. Important considerations in the assessment are the powertrain variables controlled, the technology utilized, and the fuel economy gains achieved. A detailed analysis, by engine class and control system technology, is made in order to quantify specific advantages of various electronic systems and their capability to achieve increased engine efficiency and vehicle fuel economy. An attempt is made to identify the minimum technology required to move from the 1978 emission standards of 1.5 HC/15.0 CO/2.0 NOx to the 1981 emission standard of .41 HC/3.4 CO/1.0 NOx with no fuel economy losses. This 1981 standard and the level of technology required to achieve it represents a baseline from which an analysis of further potential fuel economy gains via electronic control systems is made.

14396 **(PB—80-192776) Catalyst effectiveness of high mileage in-use vehicles. Technical report.** Platte, L. (Environmental Protection Agency, Ann Arbor, MI (USA)). Dec 1979. 15p. NTIS, PC A02/MF A01.

There has been speculation that fuel switching may have been a contributing factor to the increased ozone levels in the Los Angeles area during the recent smog alert. The rationale for the speculation is that automobiles equipped with catalytic converters emitted increased hydrocarbons (which through photochemical reactions form ozone) because of the reduced effectiveness or deactivation of the catalyst caused by the use of leaded fuel, many studies are being conducted to quantify the effect of such misfueling on the amount of pollutants emitted. However, this paper focuses on another factor related to the reduced capacity of the catalyst which also is viewed by some as a contributor to the air quality problem. The problem is the suspected inadequate performance of the catalyst due to the effects of deterioration from aging or mileage accumulation. The 'useful life' of light-duty vehicles has been defined as 50,000 miles or 5 years in Federal regulations. It is thought by some that the effectiveness of the catalyst on vehicles that are beyond their 'useful life' is drastically reduced. The higher mileage vehicles may contribute to increased hydrocarbon levels since many catalyst equipped automobiles now on the road have reached the 5 year or 50,000 mile mark.

14397 **(PB—80-199383) Effect of load and inertia on particulate emissions. Technical report.** Danielson, E. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jan 1980. 7p. NTIS, PC A02/MF A01.

This report summarizes particulate emissions data from light-duty diesel trucks operating over a range of road loads and inertia weights. The results indicate that diesel particulate emissions are relatively insensitive to road load but are significantly influenced by changes in vehicle inertia weight. Information of this nature is useful in determining differences in particulate emissions that can be expected when the same engine is applied to vehicles of different sizes and weights.

3308 Alternative Fuels

14398 **(PB—80-169162) Preparation and stability of emulsions of methanol in automotive diesel oil.** McCormack, C.G. (Council for Scientific and Industrial Research, Pretoria (South Africa). Chemical Engineering Research Group). Oct 1979. 35p. NTIS, PC A03/MF A01.

Short term emulsification of up to 20% methanol in diesel oil (stability lasting a few hours) is feasible but the emulsifiers successful in this respect are costly and have to be applied in relatively high concentrations. No emulsifier was found which produces an emulsion with long-term stability; mutual solubilities of the various components and solubility changes with temperature were identified as the most important causes. It is unlikely that an emulsifier will be found which produces stable temperature-insensitive emulsions of methanol in diesel oil. Even if such an emulsifier exists the required amount and costs are expected to be prohibitive in a fuel application.

14399 **(PB—80-188634) Methanol-gasoline fuels for automotive transportation - a review. Technical report.** Adt, R.R. Jr.; Poteat, L.E.; Doepker, R.D. (Miami Univ., Coral Gables, FL (USA)). Nov 1974. 222p. NTIS, PC A10/MF A01.

Recent concern for environmental problems and an eventual shortage of conventional petroleum-based fuels coupled with the potential of obtaining methyl alcohol (methanol) as a product of coal gasification has brought about an interest in the use of methanol as a fuel. In order to assess the feasibility of using methanol as a motor vehicle fuel, either alone (neat) or as a blend in gasoline-type base stocks, its performance, emission and practical use characteristics must be ascertained. To this end this report, which summarizes and evaluates past and current studies concerned with determining these characteristics, is offered. In addition, those performance, emission and practical use consideration characteristics deemed important and found to be lacking in the current technology are identified.

36 MATERIALS

REFER ALSO TO CITATION(S) 14470, 14471

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 13299, 13379, 13517, 13556, 13889, 13889, 13897, 13898, 13899, 13913, 13915, 13916, 13917, 13918, 13919, 13944, 13945, 13947, 13949, 13987, 13988, 14078, 15015, 15016, 15016, 15017, 15019, 15024, 15026, 15029, 15036, 15037, 15039, 15049, 15052, 15053, 15055, 15099, 15099, 15100, 15153, 15154, 15160

14400 **(BNL—28868) Voids and other neutron-produced microstructure in Mo and Mo-0.5 at. % Ti as studied by positron-annihilation techniques.** Snead, C.L. Jr.; Lynn, K.G.; Jean, Y.; Wiffen, F.W.; Schultz, P. (Brookhaven National Lab., Upton, NY (USA); Oak Ridge National Lab., TN (USA); Guelph Univ., Ontario (Canada)). 1980. Contract AC02-76CH00016. 33p. (CONF-8004146—1). NTIS, PC A03/MF A01.

From AIME meeting; Las Vegas, NV, USA (Apr 1980).

Specimens of Mo and Mo-0.5 at. % Ti which have been irradiated with neutrons ($\sim 10^{23}$ n/cm^2, E > 0.1 MeV) at temperatures between 425 and 1500°C have been studied using both lifetime and Doppler-broadening measurements. Both the shape parameter and the intensity of the lifetime component from positrons trapped at voids define swelling as a function of temperature in a way that is independent of the neutron fluence. The relative swelling as a function of irradiation temperature and the swelling peak ($\sim$ 750°C) are well defined, but no information on the magnitude

of the void volume is obtainable. In the determination of the shape and peak of the derived swelling curve, the positron analysis is more definitive than similar determinations using transmission electron microscopy.

14401 **(CONS—3205-T3) Development of a low loss magnetic composite utilizing amorphous metal flake. Third semi-annual progress report, 19 September 1979-18 March 1980.** Johnson, L. (General Electric Co., Schenectady, NY (USA). Metallurgy Lab.). Apr 1980. Contract ET-78-C-01-3205. 40p. NTIS, PC A03/MF A01.

The objective of this project is to determine the feasibility of casting amorphous metal ribbon in the shape of a helix with properties suitable for motor applications. The tasks include (1) determination of the casting parameters required to produce a helical ribbon, (2) evaluation of magnetic properties and methods for bonding, and (3) developing methods for patterning a wheel for producing motor slots in as-cast ribbon.

14402 **(EPRI-NP—1661) Analysis of radiation embrittlement reference toughness curves. Final report.** Server, W.L.; Wullaert, R.A.; Odette, G.R.; Oldfield, W. (Fracture Control Corp., Goleta, CA (USA)). Jan 1981. 110p. NTIS, PC A06/MF A01.

Three major tasks were performed: (1) statistial analysis and development of reference fracture toughness curves, (2) evaluation of fracture toughness data from surveillance (small) specimens, and (3) radiation damage analysis and modeling. Results from the first task provided techniques for statistical experimental design of radiation embrittlement programs and proper collection and qualification of experimental mechanical property data. The main accomplishment was the development of global tolerance and confidence bounds from precracked Charpy and Charpy V-notch normalization using a reference fracture toughness curve approach. The second task provided a single-specimen procedure for measuring ductile initiation toughness with side-grooved precracked Charpy specimens; additionally, excellent predictions of fracture toughness by critical stress and critical strain fracture models were made. Instrumented Charpy-type data were also maximized using various approaches. A surrogate material was developed to simulate radiation-induced damage by shock hardening. Perhaps of greatest interest was the utilization of reconstituted surveillance specimens produced from previously broken Charpy specimens. The radiation damage task produced information necessary to treat radiation embrittlement and dosimetry analysis in an improved manner. A physically based damage correlation model and a microstructural defect development model provided additional insight into radiation damage observations. 33 figures, 8 tables.

14403 **(LBL—11000) Initiation of degradation in polycrystalline sodium-beta alumina electrolytes.** De Jonghe, L.C.; Feldman, L.; Buechele, A. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). May 1980. Contract W-7405-ENG-48. 6p. (CONF-8009134—1). NTIS, PC A02/MF A01.

From 3. international meeting on solid electrolytes; Tokyo, Japan (15 Sep 1980).

Sodium-beta alumina solid electrolytes degrade during use in sodium sulfur cells. The degradation can take two forms: Mode I degradation involving the rapid propagation of macroscopic cracks driven by cathodic deposition of sodium in them; and Mode II degradation involving a slow degradation due to electron injection from the Na/β alumina contact. The initiation stage of Mode I is the most important one since cracks propagate rapidly once they are formed. The significance of the local microstructure on the Mode I initiation is discussed. It appears that grain boundaries can be favorable sites for Mode I failure initiation.

14404 **(PNL-SA—7974) Powder metallurgy titanium 6A1-4V plate.** Geisendorfer, R.F. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 12p. (CONF-800205—14). NTIS, PC A02/MF A01.

From American Institute of Metallurgical Engineers meeting; Las Vegas, NV, USA (Feb 1980).

A powder metallurgical approach has been combined with controlled mill processing to produce a highly uniform plate material suitable for structural applications. Prealloyed ELI Titanium 6A1-4V powder produced by the rotating electrode process was consolidated into billet by hot isostatic pressing. The resulting billet of uniform composition and random texture was then hot cross-rolled to 3 cm thick plate. Following rolling, the plate was given a beta annealing heat treatment to maximize damage tolerance. The plate was characterized with respect to metallurgical structure, composition, texture, and room temperature mechanical properties. The results of the study show that a powder metallurgy titanium mill product possessing uniform macro- and microstructure is technically feasible and exhibits tensile and fatigue properties equivalent to those of conventionally produced ingot-source wrought plate.

14405 **(PNL-SA—8588) Protective and non-protective oxide formation on 304 stainless steel.** Baer, D.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). May 1980. Contract AC06-76RL01830. 24p. (CONF-8006154—1). NTIS, PC A02/MF A01.

From 2. symposium on applied surface analysis; Dayton, OH, USA (11 Jun 1980).

Parameters controlling the formation of protective and non-protective oxides on 304 stainless steel were examined by using Auger electron spectroscopy to monitor oxides formed in the vacuum chamber. Variables found to influence the oxide formation include: oxygen partial pressure, the location of the oxide over a grain or grain boundary, sample grain size, and anneal treatments.

14406 **(SAND—80-1441) Thermal stress relieving of dilute uranium alloys.** Eckelmeyer, K.H. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1981. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01.

The kinetics of thermal stress relieving of uranium - 2.3 wt % niobium, uranium - 2.0 wt % molybdenum, and uranium - 0.75 wt % titanium are reported and discussed. Two temperature regimes of stress relieving are observed. In the low temperature regime ($T < 300°C$) the process appears to be controlled by an athermal microplasticity mechanism which can be completely suppressed by prior age hardening. In the high temperature regime ($300°C < T < 550°C$) the process appears to be controlled by a classical diffusional creep mechanism which is strongly dependent on temperature and time. Stress relieving is accelerated in cases where it occurs simultaneously with age hardening. The potential danger of residual stress induced stress corrosion cracking of uranium alloys is discussed.

14407 **Lattice dynamics of $LaSn_3$.** Stassis, C.; Zarestky, J.; Loong, C.; McMasters, O.D.; Nicklow, R.M. (Ames Laboratory: U. S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 5, 2227-2234(1 Mar 1981).

Inelastic neutron scattering techniques have been used to measure the phonon dispersion curves of $LaSn_3$ at room temperature and the frequencies of a selected number of phonons at 750 and 1200 K. We find that the frequencies of the optical modes in the vicinity of the first Γ_{15} point are lower than those of the corresponding modes in the isostructural compound $CeSn_3$ and decrease with decreasing temperature. The similarity of these results to those obtained in the superconducting elements Zr, Ti, Hf, and Tc suggests that these anomalies are due to the splitting of the flat doubly degenerate Δ_5 electronic bands just below E/sub F/ by the lattice distortions corresponding to these modes. The force constants obtained by fitting the experimental data to a three-nearest-neighbor Born—von Karman model were used to evaluate the phonon density of states, the lattice specific heat, and the atomic temperature factors of Ce and Sn in this compound.

14408 **Low-temperature ion beam mixing of Al-Sb.** Delafond, J.; Picraux, S.T.; Knapp, J.A. (Sandia National Laboratories, Albuqerque, New Mexico 87185). DE-AC04--DP00789. *Applied Physics Letters ;* **38**: No. 4, 237-240(15 Feb 1981).

The mixing of Sb layers on Al by 400-keV Xe ions at 80 K has been investigated. A tail in the Sb concentration profile is ob-

served to move into the Al substrate to the depth of the Xe range. The quantity of mixed Sb in the tail increases linearly with Xe fluence. No growth of layers corresponding to a binary compound is observed. However, the Sb concentration in the original layer drops continuously until the concentration reaches the first equilibrium compound phase, AlSb. The present results are believed to demonstrate pure collisional mixing of Sb into Al without the competing effects of enhanced diffusion since (i) vacancies are immobile in Al at 80 K and (ii) the observed rate of mixing, ≃2.5 Sb per Xe, is consistent with recent theoretical estimates of collisional mixing due to ion recoil and ion cascade events.

14409 **Coincidence experiments concerning convoy-electron production by 1—8.5-MeV/u highly ionized projectiles traversing polycrystalline solids and axial channels in gold.** Elston, S.B.; Sellin, I.A.; Breinig, M.; Huldt, S.; Liljeby, L.; Thoe, R.S.; Datz, S.; Overbury, S.; Laubert, R. (University of Tennessee, Knoxville, Tennessee 37916). W-7405-ENG-26. *Physical Review Letters ;* **46**: No. 5, 321-324(2 Feb 1981).

Convoy electrons produced by 1 to 8.5 MeV/u O/sup q/+ ions traversing polycrystalline C, Al, and Au targets and <110> and <100> axial channels in Au are detected in coincidence with emergent ions of charge state q/sub e/. The yield integrated over electron velocity for channeled ions depends strongly on q/sub e/, but the shape is found to be independent of q/sub e/, v, and target material. For polycrystalline and randomly oriented monocrystalline targets, the yield is found to be independent of emergent ion charge state q/sub e/. The data suggest that convoy electron production is a bulk process.

14410 **Vacancies in Al after pulsed electron beam melting.** Follstaedt, D.M.; Wampler, W.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789;. *Applied Physics Letters ;* **38**: No. 3, 140-142(1 Feb 1981).

We have used transmission electron microscopy (TEM) to study the retention of vacancies in Al after rapid melting and resolidification of a thin (~ 3 μm) surface layer using a pulsed (~50 ns) electron beam. After pulsing and aging at room temperature, TEM examination showed dislocation loops, which are interpreted to be due to the coalescence of the quenched-in vacancies on {111} planes as is the case for the loops observed in earlier furnace quenching studies. Our results indicate that the rapid melting and resolidification leaves a high vacancy concentration (~100 ppm) in the resolidified Al. Heat transport calculations show that cooling rates for the pulse heated samples (~10^8 K/s) are much higher than those achieved by conventional quenching techniques (~ 10^4 K/s).

14411 **Relationship between electronic structure and hydrogen-uptake kinetics.** El-Batanouny, M.; Strongin, M.; Williams, G.P.; Colbert, J. (Brookhaven National Laboratory, Upton, New York 11973). DE-AC02-76CH00016. *Physical Review Letters ;* **46**: No. 4, 269-272(26 Jan 1981).

Striking changes have been observed in the photoemission energy distribution curves from two phases of Pd overlayers on (110) Nb surfaces. In the commensurate (110) phase the Pd 4d band is found to have an edge about 1.5 eV below E/sub F/, similar to that of a noble metal. When the transition to the incommensurate Pd (111) phase occurs the Pd 4d bands broaden and cross the Fermi level. As the density of Pd 4d states increases near E/sub F/, a dramatic increase in the hydrogen-uptake rate through the Pd is observed.

14412 **Observation of the transition from semiconductor to high-T/sub c/ superconductor in (Sn/sub x/Eu/sub 1-x/)/sub y/Mo_6S_8 under high pressure.** Harrison, D.W.; Lim, K.C.; Thompson, J.D.; Huang, C.Y.; Hambourger, P.D.; Luo, H.L. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters ;* **46**: No. 4, 280-283(26 Jan 1981).

Pressure-induced high-temperature superconductivity has been observed in semiconducting (Sn/sub x/Eu/sub 1-x/)/sub y/Mo_6S_8, where 0< or =x< or =0.1 and y=1.0 and 1.2, having a carrier concentration ≃10^{19}/cm^3 at 4.2 K as determined from Hall effect measurements. Above a threshold pressure ≃7 kbar, superconductivity appears with dT/sub c//dP≃2 K/kbar. The maximum superconducting temperature (T/sub c/~10 K), reached at ~12 kbar, represents the highest pressure-induced T/sub c/ in any semiconductor. For P> or =13 kbar the temperature-dependent resistance appears metallic.

14413 **Radiation damage in A-15 materials: EXAFS studies.** Knapp, G.S.; Kampwirth, R.T.; Georgopoulos, P.; Brown, B.S. (Argonne National Lab., IL). pp 363-368 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

EXAFS measurements are useful in determining the local atomic environment of a particular element in a solid. Since there has been some controversy about the nature of the defects produced in A-15 materials by radiation damage, such studies were carried out on some A-15 compounds, V_3Ga which was damaged by neutrons, as well as Nb_3Ge damaged by 2.5 MeV a particles. In the V_3Ga sample, site exchange disorder seems to be the most important result of the neutron damage with less than 20% of the vanadium atoms on wrong sites. However, in the Nb_3Ge samples in addition to site exchange disorder, an unusual splitting of the first near-neighbor distance between the Ge and Nb is found. This splitting, approximately 0.2 A, may explain the large Debye Waller factors observed by Burbank et al.

3602 Ceramics, Cermets, And Refractories

14414 **(BNL—29036) Ceramic compositional analysis in archaeological perspective.** Bishop, R.L.; Rands, R.L.; Holley, G.R. (Museum of Fine Arts, Boston, MA (USA). Maya Jade and Ceramics Project; Brookhaven National Lab., Upton, NY (USA); Southern Illinois Univ., Carbondale (USA)). 1980. Contract AC02-76CH00016. 92p. NTIS, PC A05/MF A01.

The primary significance of compositional analysis in archaeology lies on the spatial dimension, in distinguishing products made by locally or regionally-based groups. If compositional analysis is to be carried beyond the descriptive recording of similarities and differences, the resource procurement zone (and its geographical relationship to inferred places of manufacture) is a basic operational concept (Rands and Bishop 1980). A zonal concept is clearly indicated in the case of pottery, which frequently is derived from raw materials, clay and temper, that do not necessarily coincide in their place of procurement. Moreover, depending on geomorphological and geochemical variables, these materials may show considerable homogeneity over a fairly extended area. On the other hand, unless there is strong, selective patterning in the exploitation of resources, great heterogeneity within a restricted region may result in fragmented procurement zones that are difficult to equate with the products of specific manufacturing centers. Under favorable circumstances, however, it appears that methods of compositional analysis are approaching the point at which microzones of limited geographical extent can be recognized and assigned heuristically useful boundaries.

14415 **(LBL—12193) Redistribution of ruthenium in UO_2 in a temperature gradient.** Zhou, S.Y.; Olander, D.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1981. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01.

The redistribution of Ru in UO_2 in a thermal gradient is substantial, with Ru moving up the temperature gradient. The apparent heat of transport of Ru in UO_2 is negative. This is believed to be the same mechanism which causes fission product Ru to redistribute in oxide fuels. The tungsten crucible reduces stoichiometric urania, and the oxygen in UO_2 under steep temperature gradient moves down the temperature. The heat of transport of oxygen vacancy in UO_2 is -138 +- 53 KJ/mole.

14416 **(PNL-SA—8672) Evaluation of ceramic and polymeric materials for use in engineered barrier systems.** Fullam, H.T.; Skiens, W.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 14p. (CONF-801124—44). NTIS, PC A02/MF A01.

From 3. annual meeting of the Materials Research Society; Boston, MA, USA (17 Nov 1980).

Ceramic materials evaluated in the screening studies were Al_2O_3 (99.8%), mullite, vitreous silica, $BaTiO_3$, $CaTiO_3$, $CaZrO_3$, $CaTiSiO_5$, TiO_2, $ZrSiO_4$, basalt, Pyroceram 9617, and Marcor code 9658 machinable glass ceramic. One grade of graphite (Toyotanso IB-11) was also evaluated. Demineralized water, a synthetic Hanford groundwater, and a synthetic NaCl brine solution were used in the screening tests. Demineralized water was used in all five of the leach tests, but the other solutions were only used in the static leach tests at 150 and 250°C. Based on the results obtained, graphite appears to be the most leach resistant of the materials tested with the two grades of alumina being the best of the ceramic materials. Titanium dioxide and ZrO_2 are the most leach resistant of the remaining materials. Candidate materials from all three general classes of polymers (thermoplastics, thermosets, and elastomers) were considered in the selection of materials. Selected groups of polymers were tested in the flowing autoclave at 150, 200, and 250°C with some polymers being further tested at the next higher temperature. Next, selected samples were exposed to gamma radiation. These samples were then submitted for tensile and elongation measurements. Selected samples which appeared promising from both autoclave and radiation testing were further evaluated by impact tests. The materials that appeared most promising after autoclave testing were the EPDM rubbers, polyphenylene sulfide, poly(ethylene-tetrafluoroethylene) copolymer, and polyfurfuryl alcohol. The radiation dose had little effect on polyfurfuryl alcohol and polyphenylene sulfide samples; very significant decreases in elongation were observed for the fluorocarbon copolymer and the EPDM rubbers. While the polyphenylene sulfide and polyfurfuryl alcohol showed little change in impact strength, poly(ethylene-tetrafluoroethylene) decreased in impact strength.

14417 **Lattice expansion as a measure of surface segregation and the solubility of hydrogen in α-FeTiH/sub x/.** Reilly, J.J.; Johnson, J.R.; Reidinger, F.; Lynch, J.F.; Tanaka, J.; Wiswall, R.H. (Brookhaven National Lab., Upton, NY). Contract DE-AC02-76CH00016. *Journal of the Less-Common Metals ;* **73**: 175-182(1980).

The lattice expansion of α-FeTiH/sub x/ as a function of hydrogen content was found to be anomalously small. Samples of α-FeTiH/sub x/ were prepared by absorbing hydrogen in previously activated strain-relieved FeTi with a specific surface area of 0.5 $m^2 g^{-1}$. The apparent partial molar volume V/sub H/ of hydrogen was 0.1 +- 0.1 cm^3 (g atom)$^{-1}$ (FeTiH/sub <0.03/); this is much lower than the accepted range of 2.2 to 1.4 cm^3 (g atom)$^{-1}$ previously reported for hydrogen-metal solutions. This behavior is attributed to preferential occupation by hydrogen of titanium-rich sites produced by surface segregation effects which are known to occur in activated FeTi. The α-(α + β) phase boundary is estimated to occur at an overall composition equivalent to FeTiH/sub ≅ 0.04/. At this composition about 85% of the total hydrogen content is estimated to be associated with surface layers approximately 100 A in depth. Unactivated (low surface area) FeTi behaved quite differently and it is clear that, in the low dilution region, surface segregation effects play a dominant role in the behavior of the system. We also present evidence that strain and dislocations produced by a hydriding-dehydriding cycle increase the hydrogen solubility and shift the phase boundary towards higher hydrogen contents.

14418 **Boron carbide/copper cermet fabrication for neutron-shielding applications.** Brassell, G.W. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 201(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

3603 Composite Materials

REFER ALSO TO CITATION(S) 14101, 14102, 14103, 14106

14419 **Critical behavior of the dielectric constant of a random composite near the percolation threshold.** Grannan, D.M.; Garland, J.C.; Tanner, D.B. (Department of Physics, Ohio State University, Columbus, Ohio 43210). DE-AS02-78ER04914. *Physical Review Letters ;* **46**: No. 5, 375-378(2 Feb 1981).

Measurements are reported of a singularity in the dielectric constant of a random metal-insulator composity below the percolation threshold. The composite sample consists of small silver particles randomly dispersed scaling relation with a critical exponent of s=0.73 +- 0.07.

3604 Polymers And Plastics

14420 **(RHO-LD—128) Laboratory study of ozone resistance of hypalon-coated Adiprene L-100.** Cleavenger, R.M.; Jansky, M.T.; Wolf, G.A. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Feb 1981. Contract AC06-77RL01030. 16p. NTIS, PC A02/MF A01.

Adiprene L-100 is a polyurethane boot material used in Hanford's Waste Encapsulation and Storage Facility. This manipulator boot material has been failing (cracking) at a significantly higher rate than anticipated. These boot failures require maintenance, which is both time-consuming and expensive. One suspected cause of failure is chemical attack by ozone. The ozone is produced by radiolysis of air. A laboratory study showed that Adiprene L-100 did not crack; i.e., fail, when exposed to 75 parts per million ozone for 180 hours. Results of this study are described in this report.

14421 **(SAND—80-2564) Analysis of epoxy resin formulations by ^{13}C NMR spectroscopy.** Assink, R.A.; Gurule, F.T. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1981. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01.

The chloroform soluble components of several epoxy resin formulations were analyzed by ^{13}C NMR spectroscopy. The technique permits the components of an epoxy resin formulation to be identified on a routine basis with a high degree of confidence. Narmco's 5208 contained MY-720 and EpiRez SU-7 or SU-8. Two versions of Ferro's CE-9000 contained ERL-0510 and EpiRez SU-7 or SU-8. Although the method is semiquantitative, it was able to distinguish between the two versions of Ferro's CE-9000 in which the concentration of ERL-0510 differs by approximately a factor of two.

14422 **Shock-compression temperature rise in polymethyl methacrylate determined from resistivity of embedded copper foils.** Bloomquist, D.D.; Sheffield, S.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789. *Applied Physics Letters ;* **38**: No. 3, 185-187(1 Feb 1981).

The temperature rise induced by shock compression of polymethyl methacrylate(PMMA) was determined from measurements of the electrical resistivity of embedded copper foils. The temperature of the copper was determined from the observed foil resistance and known values of the change in copper resistivity with temperature and shock compression. It was inferred, from equilibration evident on the records, that the copper and PMMA were at the same temperature. Observed values for the temperature rise in PMMA were 44 and 409 K for compressions of 14.0% and 22.4%, respectively; these values are in good agreement with those reported previously on the basis of thermocouple measurements.

3606 Other Materials

REFER ALSO TO CITATION(S) 13486, 13603, 13608, 13620, 13620, 13622,

13622, 14097, 14098, 14099, 14274, 14274, 14456, 15034, 15035, 15042, 15054, 15109, 15155

14423 (CONF-800402—17) Structural and magnetic properties of $DyFe_3$ hydrides. Niarchos, D.; Viccaro, P.J.; Dunlap, B.D.; Shenoy, G.K.; Aldred, A.T. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-34. 20p. NTIS, PC A02/MF A01.

From International symposium on the properties and applications of metal hydrides; Colorado Springs, CO, USA (7 Apr 1980).

The ternary hydride phases, $DyFe_3H/sub\ x/$ with x = 1.7, 2.5, and 4.2 all retain the $PuNi_3$ rhombohedral structure of $DyFe_3$ with a maximum volume expansion of 18% for $DyFe_3H/sub\ 4.2/$. All phases show a preferential expansion parallel to the c_0 axis. From bulk magnetization measurements, the Dy-Fe spin compensation temperature is found to decrease linearly from 545°K for $DyFe_3$ to 150°K for $DyFe_3H/sub\ 4.2/$ with increasing volume of the hydride phases. The ^{161}Dy Moessbauer results for the two Dy sites in the structure indicate a slight reduction occurs in free-ion moment found for $DyFe_3$ in all hydride phases. In addition, the ^{57}Fe Moessbauer data show that the average Fe moment for the five inequivalent Fe sites increases with hydrogen concentration up to x = 2.5.

14424 (PB—80-808728) Cathodoluminescence. 1970-April 1980 (citations from the NTIS Data Base). Report for 1970-April 1980. Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 66p. NTIS PC N01/MF N01.

The use of cathodoluminescence in the study of phosphors, semiconducting and other laser materials, solar cell materials, scanning electron microscopy, and, in general, solid state research, is discussed in the cited reports. Included are articles on the physical chemistry of cathodoluminescence. (Contains 50 citations)

14425 (PB—80-808736) Cathodoluminescence. 1970-April 1980 (citations from the Engineering Index Data Base). Report for 1970-April 1980. Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 179p. NTIS PC N01/MF N01.

The use of cathodoluminescence in the study of phosphors, semiconducting and other laser materials, solar cell materials, scanning electron microscopy (SEM), and in general solid state research, is discussed in these abstracts. Citations include articles on the physical chemistry of cathodoluminescence. (Contans 169 citations)

14426 (PB—80-808777) Chemiluminescence. 1977-April 1980 (citations from the NTIS Data Base). Report for 1977-April 1980. Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 212p. NTIS PC N01/MF N01.

Cited works describe the use of chemiluminescence for potential chemical laser candidate analyses, combustion studies, measurements of atmospheric properties, and related technical studies. Mention is also made of some biological sources, such as fireflies. (Contains 181 citations)

14427 (PB—80-808785) Chemiluminescence. 1970-April 1980 (citations from the Engineering Index Data Base). Report for 1970-April 1980. Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 162p. NTIS PC N01/MF N01.

Various forms of chemiluminescence, including stress-induced, laser-induced, and electrogenerated, are discussed in the cited abstracts. Air pollution measurement instrumentation is described, and measurements of hydrogen peroxide, nitrous oxide, nitric oxide, vinyl chloride and other atmospheric contaminants are delineated. (Contains 150 citations)

14428 (UCRL—85066) Deformation modelling in NaCl at intermediate and elevated temperatures. Arieli, A.; Heard, H.C.; Mukherjee, A.K. (California Univ., Davis (USA). Dept. of Mechanical Engineering; California Univ., Livermore (USA). Lawrence Livermore National Lab.). 30 Dec 1980. Contract W-7405-ENG-36. 41p. (CONF-801148—4). NTIS, PC A03/MF A01.

From ASTM conference on mechanical testing for deformation model development; Bal Harbour, FL, USA (12 Nov 1980).

The flow stress dependence on temperature and strain rate of annealed, isotropic polycrystalline NaCl has been determined at temperatures of 296 to 673°K (0.28 to 0.63 T/sub M/) and strain rates of 10^{-1} to $10^{-8}s^{-1}$. At elevated temperatures (T > ~ 0.44 T/sub M/) and relatively low stress the Na^+ diffusion-controlled climb of dislocations was found to be the rate-controlling deformation mechanism and the experimental data could be fitted by a power-law function. In the same range of temperatures, at high stresses the deformation process is controlled by dislocation climb creep due to Cl^- ion diffusion. At intermediate temperatures and low strain rates and at elevated temperatures and high strain rates the deformation was rate-controlled by the lattice resistance to the dislocation glide motion (Peierls mechanism). The constitutive equations for each deformation mechanism as well as that for the transition from one deformation mechanism to another were developed in terms of strain rate, temperature, and stress.

14429 ^{29}Si NMR spectra for reactively sputtered amorphous silicon. Jeffrey, F.R.; Murphy, P.D.; Gerstein, B.C. (Ames Laboratory—U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). 6405-ENG-82. *Physical Review [Section] B: Condensed Matter ;* **23**: No. 5, 2099-2101(1 Mar 1981).

High-resolution nuclear magnetic resonance using magic-angle spinning has been applied to reactively sputtered amorphous Si-H. The line broadening expected from dispersion in the paramagnetic shielding due to charge-density variations is calculated and compared to experiment. A substantial upfield shift from amorphous Si-H produced by glow discharge is noted.

14430 Shock-wave production and plasma motion in CO_2-laser-irradiated targets. Goldstone, P.D.; Benjamin, R.F.; Schultz, R.B. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). W-7405-ENG.36. *Applied Physics Letters ;* **38**: No. 4, 223-225(15 Feb 1981).

We use visible-light, streaked shadowgraphy to make to first measurements of several transport and expansion phenomena in CO_2-laser-irradiated foils. Measured velocities of the free-surface motion, produced by the laser-driven shock wave, at the foil's rear surface yield shock pressures in reasonable agreement with theory. The velocity of plasma expansion from the absorption region is observed to change abruptly after ~1.5 ns. We speculate that this effect is due to relaxation of the steepened plasma profile. Energy transport from the front to rear surface via the target's edge, which complicated shock studies, is controllable with a simple shield.

14431 Laser annealing of native oxides on GaAs. Ahrenkiel, R.K.; Anderson, G.; Dunlavy, D.; Maggiore, C.; Hammond, R.B.; Stotlar, S. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). W-7405-ENG. 36. *Applied Physics Letters ;* **38**: No. 4, 279-281(15 Feb 1981).

Annealing of native oxides grown on GaAs has been performed using a pulsed KrF laser. This process allows the oxides to be heated to temperatures well above 500 °C without arsenic loss from the GaAs substrate. The physical, chemical, and electronic properties of the oxide are markedly changed by laser processing.

14432 Phonons in the graphite-potassium intercalation compound $C_{36}K$. Magerl, A.; Zabel, H. (National Measurement Laboratory, National Bureau of Standards, Washington, D. C. 20234). DE-AC02-76ER01198. *Physical Review Letters ;* **46**: No. 6, 444-446(9 Feb 1981).

An inelastic—neutron-scattering study of the [001] L phonons in $C_{36}K$ shows, for the first time, zone-folding effects along with frequency gaps between acoustic and optic modes. Phonon dispersion and structure factors can be modeled by a linear chain

with two different masses and two force constants: $phi_1 = 3450$ dyn/cm for the coupling of graphite and potassium planes, and $phi_2 = 2850$ dyn/cm for the coupling between two adjacent graphite planes.

14433 **Competition between ferromagnetism and superconductivity in $HoMo_6S_8$.** Lynn, J.W.; Shirane, G.; Thomlinson, W.; Shelton, R.N. (Department of Physics, University of Maryland, College Park, Maryland 20742). DE-AC02-76CH00016;W-7405-ENG-82/WPAS-KC-02-02-02. *Physical Review Letters ;* **46**: No. 5, 368-371(2 Feb 1981).

Neutron scattering has been used to investigate the development of magnetic order in the region of the reentrant superconducting transition in $HoMo_6S_8$. On cooling, an ordered oscillatory magnetic state develops in the superconducting phase, with a wavelength which increases with the application of a magnetic field. On further cooling the sample reverts to the normal conducting state as ferromagnetism sets in. No oscillatory magnetic phase is observed, however, when the superconducting phase is approached from low temperatures.

14434 **Selective observation of electrically active grain boundaries in silicon.** Redfield, D. (RCA Laboratories, Princeton, New Jersey 08540). XS9-8276-1. *Applied Physics Letters ;* **38**: No. 3, 174-176(1 Feb 1981).

A simple technique is described for selective observation of those grain boundaries in polycrystalline Si that would be most harmful to the properties of a solar cell if a cell were to be made from that material. The technique is based on the alteration of the optic axis of liquid crystals by fringing fields at the surface of polycrystalline Si. It is found that the pattern of boundaries seen this way correlates well with the pattern of the most active boundaries as seen in a light-spot scan of a solar cell. This technique has revealed that in p-type Wacker "Silso" material, the electrical properties of grain boundaries are strongly affected by heat treatment.

14435 **Effect of background gas on the propagation of a high-intensity Nd: glass laser beam to a target.** Palmer, R.E.; Anthes, J.P.; Palmer, M.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). N/A. *Journal of Applied Physics ;* **52**: No. 1, 1-3(Jan 1981).

The x-ray emission from a Ni target irradiated with an 8-ns Nd: glass laser pulse focused to $\sim 5 \times 10^{13}$ W/cm^2 did not change when up to 2-torr Xe was added to the target chamber. This suggests that the incident laser beam was not affected appreciably as it propagated through the background gas to the target.

14436 **Charge exchange and energy loss of carbon ions in air-plasma channels.** Wright, T.P.; Green, T.A.; Mehlhorn, T.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics ;* **52**: No. 1, 147-150(Jan 1981).

A model is developed to study two loss mechanisms duing the propagation of high-power beams of carbon ions in current-carrying air-plasma channels. Such channels can provide the necessary standoff between the diodes and the target in light-ion-driven inertial confinement fusion. Particle losses due to radial charge exchange diffusion across the channel magnetic field as well as collisional energy losses are studied. Semiempirical charge exchange cross sections are derived from literature sources and used in a Monte Carlo transport code with the energy loss modeled in the continuous slowing down approximation. We conclude that charge exchange losses are probably not of major concern for light ion beam inertial confinement fusion reactor configurations using channel transport, whereas collisional energy loss can be detrimental if the plasma channel density is too large.

14437 **Electric field distribution associated with prebreakdown phenomena in nitrobenzene.** Kelley, E.F.; Hebner, R.E. Jr. (Electrosystems Division, National Bureau of Standards, Washington, D.C. 20234). *Journal of Applied Physics ;* **52**: No. 1, 191-195(Jan 1981).

The electric field distribution between a prebreakdown tree and the electrode toward which it is propagating is determined. The electric field is measured in nitrobenzene, using the electro-optic Kerr effect. High-speed photography is used to provide a 10-ns resolution of the transient, prebreakdown events. The measurements show that to predict the Kerr fringe pattern, and thus the electric field distribution, it is sufficient to model the prebreakdown tree as a spherical conductor about the same size as the tree and at the potential of the electrode from which the tree is propagating.

14438 **Segregation in Czochralski grown calcium gallium germanium garnet single crystals.** Roth, T.F.; Mishra, R.K.; Thomas, G. (IBM, San Jose, California 95193). W-7405-ENG-48. *Journal of Applied Physics ;* **52**: No. 1, 219-226(Jan 1981).

Morphology and crystallography of the formation of small segregates in Czochralski grown calcium gallium germanium garnet are studied using TEM and STEM. Based on the observations, the following model has been developed for the formation of these defects. Evaporative loss of Ge from the melt during the crystal growth and the resulting local deviations from stoichiometry lead to random nucleation of small plate-like precipitates, rich in Ga. As these precipitates grow, strain field interaction leads first to the formation of three-dimensional segregates, and later to their alignment along the elastically soft <100> directions. Isolated segregates are also observed. Some of the segregates contain a central void filled with oxygen gas, while some others with or without a void have one or more dislocation loops around them. These segregates have the same garnet structure but a different chemical composition; they are rich in Ga and depleted in Ge. The model suggests that segregate-free crystals can be grown by suppressing the evaporative loss of Ge from the melt during crystal growth.

14439 **High-pressure behavior of α-quartz, oxynitride, and nitride structures.** Cartz, L.; Jorgensen, J. (College of Engineering, Marquette University, 1515 W. Wisconsin Avenue, Milwaukee, Wisconsin 53233). W-31-109-ENG-38. *Journal of Applied Physics ;* **52**: No. 1, 236-244(Jan 1981).

The high-pressure behavior of α-quartz SiO_2 and GeO_2, oxynitrides Si_2N_2O and Ge_2N_2O and α- and β-Si_3N_4 depends markedly on the nature of the linking of the coordination polyhedra in their crystal structures. Where bond angles can vary between neighboring polyhedra linked at one corner, relative tilting or rotations can occur modifying the aspect of the three-dimensional framework. Such fine structural rearrangements can dominate the reponse of the crystal structure to applied stresses as induced by the application of high pressures or by temperature changes. Direct evidence for this is available from structural measurements at high pressure using time-of-flight neutron diffraction with multicomponent profile refinement procedures, where atomic position changes have been determined up to pressures of $\sim 3 \times 10^9$ Pa. The crystal structures studied are the flexible α-quartz structures of SiO_2 and GeO_2, the partially flexible structures Si_2N_2O and Ge_2N_2O, and the rigid structures α- and β-Si_3N_4. The volume compressibility coefficients K/sub v/ are greatest for α-quartz SiO_2 (274×10^{-13} Pa^{-1}) and GeO_2 (256×10^{-13} Pa^{-1}) with the Si-O-Si and Ge-O-Ge angles varying the most; K/sub v/ is intermediate for Si_2N_2O (79 x 10-13 Pa^{-1}) and Ge_2N_2O (99×10^{-13} Pa^{-1}) where the Si-O-Si and Ge-O-Ge angles vary appreciably while the bond angles to the nitrogens change only slightly; K/sub v/ is least for α-Si_3N_4 (35.5×10^{-13} Pa^{-1}) and β-Si_3N_4 (27.5×10^{-13} Pa^{-1}) where no bond angles vary appreciably. For all of the structures examined, bond length changes with pressure are very small in comparison to bond angle changes, which can be an order of magnitude greater. Each structural type behaves in a characteristic way. For example, Si_2N_2O and Ge_2N_2O exhibit almost identical responses to pressure.

14440 **Generalized Hall-effect measurement geometries and limitations of van der Pauw-type Hall-effect measurements.** Boerger, D.M.; Kramer, J.J.; Partain, L.D. (Electrical Engineering Department, University of Delaware, Newark, Delaware 19711). *Journal of Applied Physics ;* **52**: No. 1, 269-274(Jan 1981).

A rigorous derivation is given to generalize the allowed, Hall effect, sample shapes from the restrictive, rectangular parallelepiped configurations to a much more general class of geometries characterized by mirror symmetry for materials whose mobile carriers have surfaces of constant energy in k-bar space that are well described by ellipsoids. However, this mirror symmetry condition is more restrictive than the almost arbitrary sample shapes proposed

with the van der Pauw technique for thin films. Experimental data taken on n-type CdS at liquid-nitrogen temperatures in magnetic field strengths of 8 and 145 kG show that errors ranging from 1 to 600% can result from van der Pauw-type geometries depending on how much the sample shape and/or contact arrangement differs from the mirror symmetry. An empirically derived averaging technique is described that reduces the observed errors to less than 13% even with van der Pauw-type shapes that do not meet the mirror symmetry conditions.

14441 **Coadsorption of cesium and oxygen on iridium and lanthanum hexaboride.** Danielson, L.R. (Thermo Electron Corporation, 85 First Avenue, Waltham, Massachusetts 02154). DE-AC02-76ET11292. *Journal of Applied Physics ;* **52**: No. 1, 300-304(Jan 1981).

The coadsorption of cesium and oxygen on iridium and lanthanum hexaboride has been studied by measurements of elemental surface concentrations, work functions, and electron reflectivities. The elemental surface concentrations were determined by Auger electron spectroscopy and the work functions and reflectivities by the field emission retarding potential technique. Simultaneous deposition of cesium and oxygen on iridium or lanthanum hexaboride substrates produced a thick oxide layer. For both substrates this oxide layer possessed a work function of 1.0 +- 0.05 eV and an electron reflectivity at threshold of 0.45 +- 0.10 eV. Brief stepwise heatings of this layer on LaB_6 showed stability to 390 K. The threshold reflectivity for some higher work function surfaces depended strongly on whether the final deposition was cesium or oxygen.

14442 **ν_3 vibrational ladder of SF_6.** Patterson, C.W.; Krohn, B.J.; Pine, A.S. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Optics Letters ;* **6**: No. 1, 39-41(Jan 1981).

From an analysis of the high-resolution spectrum of the $3\nu_3$ manifold of SF_6, we have determined the anharmonicity constants to be (in reciprocal centimeters) $X_{33}=-1.7426$, $G_{33}=0.9188$, and $T_{33}=-0.24635$. By using these constants, one can for the first time to our knowledge accurately predict the energies of the lower-vibrational sublevels of the ν_3 ladder and determine the pathways for multiple-photon absorption.

14443 **Themoelectric power and conductivity of As-doped a-Si:H:F.** Nielsen, P.; Dalal, V.L. (Institute of Energy Conversion, University of Delaware, Newark, Delaware 19711). 03-79-ET-23034. *Applied Physics Letters ;* **37**: No. 12, 1090-1092(15 Dec 1980).

Thermoelectric power and conductivity measurements on As-doped a-Si:H:F have been combined with exact computations of conductivity and thermopower to determine the midgap density of states (10^{16} eV^{-1} cm^{-3}) and maximum mobility (11 cm^2 V^{-1} sec^{-1}). The mobility edge is found to lie significantly deeper in the gap than in a-Si:H.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

14444 **(ORNL-tr—4720) Mathematical description of extraction processes and automatic control of them.** Rozen, A.M.; Mitskevich, Yu.G.; Reshet'ko, Yu.V.; Shcherbatykh, V.I.; Zhuromskii, V.M.; Andronov, V.G.; Vasil'ev, V.A. (Oak Ridge National Lab., TN (USA)). [nd]. Translated from 3rd Tr. Vses. Nauch.-Tekh. Soveshch., Zhidk. Ekstr., 1969. 28p. NTIS, PC A03/MF A01.

This report, consisting of a summary of studies, presents data concerning the elaboration and experimental verification of a mathematical model of the extraction process, and it also presents a discussion of some schemes of automatic regulation and optimum control of the process. It contains an examination of the dynamics of extraction, predominantly for mixer-settling tank type apparatus, but some features of the model and the scheme of automatic regulation can be extended to column-type apparatus. The problem to be solved determines the required degree of detail to be achieved and the precision of mathematical description necessary. Thus, in order to design apparatus, there must be available the most complete equations which describe the hydrodynamics and the mass transfer of the extraction stage; for selection of optimum conditions and calculation of static characteristics, it is convenient to use steady-state equations of material balance and the equilibrium equation with consideration of the effectiveness of the stage. Problems of synthesis of a system of automatic control and optimum control may be solved with the use of non-steady-state equations of material balance and equilibrium equations. In the general case, description of the process leads to a cumbersome system of differential equations, the solution of which might involve laborious calculations. Therefore it is advisable to simplify the mathematical model wherever the conditions of the problem to be solved permit. In compiling models, the well-known principle of dividing a complex process into several elementary processes, described by comparatively simple equations was followed.

14445 **(CONF-810203—3) Continuous ion exchange separation of zirconium and hafnium.** Begovich, J.M.; Sisson, W.G. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01.

From AIME annual meeting; Chicago, IL, USA (22 Feb 1981).

A pressurized continuous annular chromatograph (CAC) has been developed for truly continuous ion exchange preparative separations. This device utilizes a slowly rotating annular bed of sorbent material, fixed multiple feed points, and fixed withdrawal locations. Most of our investigations have been performed with a 28-cm-diam by 60-cm-long CAC, but a larger model has recently been designed and constructed. A detailed study has been made of the separation of copper, nickel, and cobalt components from a simulated carbonate leach liquor of the Caron process for recovering nickel and cobalt from laterite ores. Recent studies have investigated the ion exchange separation of zirconium and hafnium from a sulfate feed solution. Nuclear reactor-grade zirconium, containing $<$ 0.01 wt % hafnium, and hafnium, containing $<$ 1% zirconium, have been continuously prepared using cation exchange resin in the pressurized CAC. This device, because of its continuous feed and product withdrawal, its adaptability to largescale operations, and its ability to separate many components, is expected to make chromatography a more competitive process in the industrial sector.

14446 **(CONF-810203—5) Separation of hafnium from zirconium in sulfuric acid solutions using pressurized ion exchange.** Hurst, F.J. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01.

From AIME annual meeting; Chicago, IL, USA (22 Feb 1981).

High-resolution pressurized ion exchange has been used successfully to study and separate hafnium and zirconium sulfate complexes by chromatographic elution from Dowex 50W-X8 (15 to 25 μm) resin with sulfuric acid solutions. Techniques were developed to continuously monitor the column effluents for zirconium and hafnium by reaction with fluorometric and colorimetric reagents. Since neither reagent was specific for either metal ion, peak patterns were initially identified by using the stable isotopes ^{90}Zr and ^{180}Hf as fingerprints of their elution position. Distribution ratios for both zirconium and hafnium decrease as the inverse fourth power of the sulfuric acid concentration below 2N and as the inverse second power at higher acid concentration. The hafnium-to-zirconium separation factor is approximately constant ($\sim$ 8) over the 0.5 to 3N range. Under certain conditions, an unseparated fraction was observed that was not retained by the resin. The amount of this fraction which is thought to be a polymeric hydrolysis product appears to be a function of metal and sulfuric acid concentrations. Conditions are being sought to give the highest zirconium concentration and the lowest acid concentration that can be used as a feed material for commercial scale-up in the continuous annular chromatographic (CAC) unit without formation of the polymer.

14447 (DOE/LETC/TPR—81-1) Analysis of selected trace metals in leachate from reference fly ash. Phase II. Supplemental leaching program. Final report. Webster, W.C.; Jackson, K.F.; Paule, R.C. (Department of Energy, Laramie, WY (USA). Laramie Energy Technology Center; National Bureau of Standards, Washington, DC (USA)). Mar 1981. 57p. NTIS, PC A04/MF A01.

An inter-laboratory testing program was conducted to isolate and measure the primary components of variability in the American Society for Testing and Materials' (ASTM) and Environmental Protection Agency's (EPA) extraction procedures for testing the leaching potential of solid wastes. The program is a continuation of the Collaborative Test Programs undertaken jointly by ASTM Subcommittee D19.12 and the US Department of Energy (DOE). The National Bureau of Standards was retained by DOE to design the program and analyze the results. Engineering-Science provided initial program coordination, and Webster and Associates coodinated the data analysis and preparation of the report, both under contract to DOE. Thirteen laboratories participated in the program, all on a voluntary basis. In carrying out the program, specially prepared samples of a Reference Fly Ash were utilized in order to minimize sample heterogeneity. Each laboratory preformed both the ASTM and EPA extraction procedures on the Reference Fly Ash in duplicate, split the extract into two equal portions, completed duplicate analytical determinations on one portion, and shipped the other portion to a central laboratory. The central laboratory performed duplicate analytical determinations on all extracts. The main observations and conclusions from the test program are: (1) sampling may be a large variable in field situations; however, with the use of the Reference Fly Ash, sample heterogeneity was controlled, allowing analysis of effects other than sampling variability; (2) the cooperating laboratories demonstrated acceptable analytical reproducibility based on analytical quality control data; (3) poor reproducibility of the trace metal results on the extracts from the Reference Fly Ash was shown to be primarily due to variability in the leaching process rather than analytical technique.

14448 (DP-MS—80-87) Versatile multicomputer data system. Overman, R.F.; Sand, R.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1981. Contract AC09-76SR00001. 18p. (CONF-810329—3). NTIS, PC A02/MF A01.

From Pittsburgh conference of analytical chemistry and applied spectroscopy; Atlantic City, NJ, USA (9 Mar 1981).

A multicomputer system was designed and built to provide a means of transferring data from analytical instruments to a PDP-15 (Digital Equipment Corp., Maynard, MA) minicomputer. A model 6800 microcomputer (Motorola, Inc., Phoenix, AZ) was designed to accept data from instruments with diverse data formats and data collection times on a time-sharing basis. Once in the computer memory, the data are sent via a modified serial communications port to a PDP-15 minicomputer. The analytical instruments include an infrared spectrometer, two pulse height analyzers, an atomic absorption spectrophotometer, and a desk-top computer. This paper describes the versatility of the system, the microcomputer handling of the instrument I/O requirements, the changes in the PDP-15 to accept data at a 2400 baud rate, and changes in the TTY handler in the monitor to accommodate binary data and nonstandard byte configurations.

14449 (ENICO—1056) Determination of cerium in ICPP reprocessing solutions using induction coupled plasma optical emission spectroscopy. Stone, R.W.; Olsen, V.R. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Jan 1981. Contract AC07-79ID01675. 21p. NTIS, PC A02/MF A01.

An analytical method has been developed to determine the cerium concentration of solutions used in actinide removal pilot plant studies. Detection limits of cerium are 8×10^{-6} g/L in 0.005 N HNO_3 solutions, 2×10^{-5} g/L in organic solutions, and 3×10^{-4} g/L in coprocessing dissolver solution. The overall precision of the method is +- 2.5%. The procedure utilizes the inductively coupled plasma optical emission spectrometry (ICP-OES) method of analysis.

14450 (ENICO—1074) Computerized emulsion calibration of spectrographic plates using a desktop computer. Stone, R.W.; Lyon, T.R.; Pavlica, D.A. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Jan 1981. Contract AC07-79ID01675. 35p. NTIS, PC A03/MF A01.

A Hewlett-Packard 9825A computer was interfaced to two microphotometers and computer programs were written to perform the functions necessary for calibrating photographic emulsions. The transmittance values obtained from the interface were converted to Seidel values and a quartic polynomial preliminary curve derived. The emulsion characteristic curve consisting of Seidel transform versus log of the relative intensity was described by another quartic polynomial curve. A table of percent transmission versus relative intensity was then printed. The interface and computer programs eliminate all hand transcription of data and reduce the calibration time from 3 to 4 days to about 5 hours.

14451 (PB—80-178429) The effect of heating rate upon the coupling of complex reactions. I. Independent and competitive reactions. Final report. Flynn, J.H. (National Bureau of Standards, Washington, DC (USA)). 1980. 14p. Pub. in Proceedings of North American Thermal Analysis Society Meeting (7th), St. Louis, MO, September 27, 1977, Thermochim. Acta 37, p225-238 1980.

Theoretical curves of the rate of conversion vs. temperature at constant heating rate for first-order reactions with activation energies of 80, 160, 240 and 320 kJ/mole are compared over a range of heating rates from 10 to the -9 power to 10 to the 5th power K/s for independent and competitive reactions. Independent reactions with differnet activation energies may be separated from one another by either increasing or decreasing the rate of heating. The spectrum of derivative peaks for two competing reactions at various heating rates has a dispersion effect in the region of change from low to high activation energy reactions. The practical range of heating rates in thermal analytical experiments and the application of these model cases to the understanding of the kinetics of complex systems at high and low temperatures are discussed.

14452 (PB—80-197346) Study to improve EPA Methods 15 and 16 for reduced sulfur compounds. Final report. Hamil, H.F.; Swynnerton, N.F. (Southwest Research Inst., San Antonio, TX (USA)). Apr 1980. Contract EPA-68-02-2489. 63p. NTIS, PC A04/MF A01.

EPA source test methods for reduced sulfur compounds, Method 15 for Claus sulfur recovery plants and Method 16 for Kraft pulp mills have been evaluated, and information is provided for the user. Techniques and procedures for the gas chromatographic measurement of hydrogen sulfide, carbonoxysulfide, carbon disulfide, methylmercaptan, dimethylsulfide and dimethyldisulfide were studied. Absorption of these species on the surfaces of the chromatographic system was found to be the main source of imprecision and inaccuracy in the analysis. Permeation devices containing the above sulfur compounds were found to permeate at uniform rates after one year of use. Aluminum cylinders containing compressed gas mixtures of the compounds under investigation were analyzed for four months. Results showed them to be stable in some instances and to be promising candidates for quality assurance materials. Comparison of an electrolytic conductivity detector with a flame photometric detector showed the former to be valuable for the analysis of reduced sulfur compounds under laboratory conditions.

14453 (SAND—80-2390) High pressure liquid chromatographic method for CP amide analysis. Loyola, V.M.; Womelsduff, J.E. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1981. Contract AC04-76DP00789. 26p. NTIS, PC A03/MF A01.

A method has been developed for the analysis of the 5-carboxamidotetrazolatopentaamminecobalt(III) perchlorate contaminant of the explosive CP (2-(5-cyanotetrazolato)-pentaamminecobalt(III) perchlorate). The analysis utilizes a Zn/Hg reduction of the cobalt (III) complexes to allow a high pressure liquid chromatographic (HPLC) analysis of the reaction products; the product analysis is directly related to the weight percent of impurity present in the explosive. The technique is described and shortcomings pointed out.

14454 **Infrared double resonance of SF_6 with a tunable diode laser. II. Line shape analysis.** Reiser, C.; Steinfeld, J.I.; Galbraith, H.W. (Department of Chemistry, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Journal of Chemical Physics, The ;* **74**: No. 4, 2189-2194(15 Feb 1981).

Two- and three-level diode—infrared laser double resonance experiments in SF_6 are modeled in terms of a superposition of non-interacting pairs of levels. The Mollow or Haensch—Toschek line shape functions give a good representation of the observed spectra, with all features describable as either saturated or Stark-modulated transitions. No evidence for intramolecular coupling is seen at $v_3=1$ of SF_6.

14455 **ESR studies of O^-_2 adsorbed on Ti supported surfaces: Analysis of motional dynamics.** Shiotani, M.; Moro, G.; Freed, J.H. (Baker Laboratory of Chemistry, Cornell University, Ithaca, New York 14850). *Journal of Chemical Physics, The ;* **74**: No. 4, 2616-2640(15 Feb 1981).

Temperature-dependent ESR spectra of O^-_2 adsorbed on Ti ions supported on porous Vycor glass were observed over the range 4.2 to 400 °K. These spectra were obtained under normal high vacuum conditions as well as under UHV conditions ($P< $ or $=10^{-9}$ Torr) and are very well resolved. It was observed that the line position of the g tensor component that is perpendicular to the internuclear axis of O^-_2 remained constant with temperature, whereas the other two components of the g tensor shift in position with temperature, and are accompanied by drastic line shape changes. This observation indicates that the molecular motion of O^-_2 on the surface is highly anisotropic, consisting essentially of planar rotation about the axis perpendicular to the internuclear axis of O^-_2 and parallel to the normal to the surface. Furthermore, the observation of nonequivalent ^{17}O hfs of O^-_2 suggests that the internuclear axis of O^-_2 might be tilted slightly from the surface and/or one oxygen is closer to the Ti^{4+}. The ESR line shapes were simulated for the different possible models: Brownian diffusion, jump diffusion (from weak jump to strong jump), approximate free diffusion, and discrete jump. It was found that the theoretical spectra calculated using the model of weak jump rotational diffusion best fit the observed spectra in the temperature range below 57.4 °K. However, in the temperature range above 57.4 °K, although the Brownian diffusion model seems the best among the models used, none of the present models used could successfully reproduce the observed line shapes. The rotational correlation time tau/sub R/ parallel was found to range between 10^{-5} sec (below 14.5 °K) and 10^{-9} sec (263 °K). The values of tau/sub R/parallel depend strongly on the model used in the lower temperature range, but were essentially independent of model above 100 °K. The activation energy for rotational diffusion was estimated to be 0.5 kcal/mole above 100 °K.

14456 **Ion dip spectroscopy: A new technique of multiphoton ionization spectroscopy applied to I_2.** Cooper, D.E.; Klimcak, C.M.; Wessel, J.E. (The Aerospace Corporation, Los Angeles, California 90009). DE-AC03-79EV10239. *Physical Review Letters ;* **46**: No. 5, 324-328(2 Feb 1981).

A new method of high-resolution multiphoton spectroscopy based on competition between ionization and stimulated emission channels is described. It combines features of multiphoton photoionization with those of optical-optical double resonance. Results obtained for I_2 demonstrate the method and identify intermediate states involved in multiphoton photoionization. The method offers the potential for extremely sensitive sub-Doppler spectrosocpy of complex molecules.

14457 **Double-resonance study of vibrational equilibration in optically pumped laser molecules.** Lawandy, N.M.; Koepf, G.A. (Instrument Electro-Optics Branch, Instrument Division, Goddard Space Flight Center, Greenbelt, Maryland 20771). *Optics Letters ;* **6**: No. 1, 42-44(Jan 1981).

A cw frequency-locked CO_2 laser is used in conjunction with a 1-J TEA CO_2 laser to observe the vibrational equilibration of optically pumped gases. Velocity-dependent effects in the vibrational-deactivation rate are also observed. Experimental results are given for CH_3F.

14458 **Structural changes in micellar solutions and microemulsions and their relevance to emulsion counting.** Boussaha, A.; Ache, H.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Journal of Physical Chemistry, The ;* **84**: No. 24, 3249-3254(27 Nov 1980).

β-counting efficiencies or the decrease of the amplitude of the signals originating from the interaction of low energetic β particles with typical emulsion counting solutions as measured by a conventional liquid scintillation spectrometer reflect very sensitively structural changes occurring in these solutions upon addition of water or aqueous samples. It appears that the capability of the species present in the solutions, reverse micelles, microemulsion droplets, etc., to trap electrons determines the size of the output signal and thus the counting efficiency to a significant extent. The positronium formation process shows a similar behavior and seems to be affected by the same parameters. Both processes provide very sensitive probes for the study of structural changes in micellar solutions or microemulsions.

14459 **Optical molecular dephasing: principles of and probings by coherent laser spectroscopy.** Zewail, A.H. (California Inst. of Technology, Pasadena). *Accounts of Chemical Research ;* **13**: No. 10, 360-368(Oct 1980).

The principles of coherent laser spectroscopy and how it is used to examine chemical and physical processes relevant to molecular systems is focused on.

14460 **Liquid chromatographic fractionations of mixtures of polystyrene oligomers.** Curtis, M.A.; Webb, J.W.; Warren, D.C.; Brandt, V.O.; Gerberich, F.G.; Raut, K.B.; Rogers, L.B. (Univ. of Georgia, Athens). Contract EY-76-S-09-854. *Separation Science and Technology ;* **15**: No. 7, 1413-1428(1980).

Oligomer mixtures of 800, 2200, and 4000 molecular weight polystyrene have been fractionated using silica and bonded phase columns under similar conditions of solvent gradient and flow rate. Using a hexane tetrahydrofuran gradient, the silica and nitro phases were best in that they separated 41 and 43 oligomers, respectively. At the other extreme, a phenyl bonded phase column gave virtually no resolution using a water/THF gradient, and a cyano bonded phase column, using the earlier hexane/tetrahydrofuran system, resolved only 10 oligomers. Amino and octadecyl bonded phase columns gave results intermediate between these two extremes. The strength of the solvent used to dissolve the sample was found to be of critical importance. Use of too good a sample solvent seriously degraded the attainable resolution. When number-average and weight-average molecular weights for an 800 molecular weight polystyrene sample were calculated from the oligomer distribution, the silica column gave values which were most consistent with those reported from other methods. 5 figures, 4 tables.

14461 **Gas chromatographic studies of the relative retention of the sulfur isotopes in carbonyl sulfide, carbon disulfide, and sulfur dioxide.** Fetzer, J.C.; Rogers, L.B. (Univ. of Georgia, Athens). *Separation Science and Technology ;* **15**: No. 8, 1579-1587(1980).

A precision gas chromatograph, coupled to a quadrupole mass spectrometer and an on-line computer, was used to study the fractionation on Porasil A of the $^{32}S/^{34}S$ isotopic pair in a variety of sulfur-containing molecules. Carbonyl sulfide yielded an average α value of 1.00074 +- 0.00017 (standard deviation) for the temperature range 25 to 75°C. The carbon disulfide value was 1.00069 +- 0.00023 for the range 53 to 103°C, and that for sulfur dioxide was 1.00090 +- 0.00018 for the range 62 to 112°C. Differential thermodynamic data have been reported. A Porapak Q column showed no fractionation of this isotopic pair in these three molecules.

14462 **Evaluation of treatments to attain isotopic equilibration of plutonium preceding the resin bead technique for mass spectrometric assay analysis of spent reactor fuel.** Marsh, S.F.; Abernathey, R.M.; Rein, J.E. (Los Alamos Scientific Lab., NM). *Analytical Letters ;* **13**: No. A17, 1487-1495(1980).

Ten chemical treatments are evaluated for the attainment of isotopic equilibration of plutonium prior to its sorption on resin beads for assay of dissolved reactor fuel by isotope-dilution mass

spectrometry. The one consistently reliable treatment is reduction to Pu(III) with heated ferrous sulfamate followed by oxidation to Pu(IV) with heated sodium nitrite.

14463 Bis(octadecyl phosphate)zirconium(IV). Novel support for reversed-phase chromatography. Maya, L.; Danis, P.O. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Journal of Chromatography ;* **190**: 145-149(1980).

In a recent study the structure and chromatographic application of crystalline compounds $Zr(O_3POR)_2$, where R = butyl, lauryl and octylphenyl, were explored. Preliminary results, obtained with the lauryl derivative in the separation of aromatic hydrocarbons by reversed-phase chromatography (RPC), showed that this type of compound could offer an alternative to the well established silica based RPC supports. Clearly, the advantage in using the zirconium phosphate-based supports resides in the control of the carbon loadings that can be obtained since these compounds are the products of a homogeneous reaction with a well defined stoichiometry. This communication describes the preparation of the octadecyl derivative and the evaluation of its performance as a RPC support.

14464 Microtitration of various anions with quaternary ammonium halides using solid-state electrodes. Selig, W. (Univ. of California, Livermore). Contract W-7405-ENG-48. *Microchemical Journal ;* **25**: 200-208(1980).

Many solid-state electrodes were found to respond as endpoint detectors in the potentiometric titration of large inorganic and organic anions with quaternary ammonium halides. The best response was obtained with the iodide and cyanide electrodes although practically any electrode can function as endpoint sensor. The titrants were hexadecylpyridinium chloride and hexadecyltrimethylammonium chloride; hexadecyltrimethylammonium bromide and Hyamine 1622 may also be used. Some inorganic anions thus titratable are perrhenate, persulfate, ferricyanide, hexafluorophosphate, and hexachloroplatinate. Examples of organic anions titratable are nitroform, tetraphenylborate, cyanotriphenylborate, picrate, long-chain sulfates and sulfonates, and some soaps. The reverse titration of quaternary ammonium halides vs dodecylsulfate is also feasible. Some titrations are feasible in a partially nonaqueous medium.

14465 Demonstration of the potential for designing extractants with preselected extraction properties: possible application to reactor fuel reprocessing. Mason, G.W.; Griffin, H.E. (Argonne National Lab., IL). *ACS (American Chemical Society) Symposium Series ;* No. 117, 89-99(1980).

From the knowledge of the extractant characteristics of both neutral and mono-acidic phosphorus-based organic compounds now available, it is possible to tailor-make extractants for a specifically desired separation of two metals. The present study is concerned with neutral mono-nuclear, phosphorus-based extractants for use in affecting the mutual separation of U(VI) and Th(IV). The wide range of separation factors, K/sub U//K/sub Th/, obtained for the extraction of U(VI) and Th(IV) from 2.00 M HNO_3 into eleven selected neutral phosphorus-based extractants, demonstrates the potential for designing extractant systems for specific metal separations. The separation factors range from 0.71 for butyl dibutyl phosphinate B[DBP] to 162 for D(4-MPe-2)[iBP]: a K/sub U//K/sub Th/ ratio of 228.

14466 Extraction of DBP and MBP from actinides: application to the recovery of actinides from TBP-sodium carbonate scrub solutions. Horwitz, E.P.; Mason, G.W.; Bloomquist, C.A.A.; Leonard, R.A.; Bernstein, G.J. (Argonne National Lab., IL). *ACS (American Chemical Society) Symposium Series ;* No. 117, 475-496(1980).

A flowsheet for the recovery of actinides from TBP-Na_2CO_3 scrub waste solutions has been developed, based on batch extraction data, and tested, using laboratory scale counter-current extraction techniques. The process, called the ARALEX process, utilizes 2-ethyl-1-hexanol (2-EHOH) to extract the TBP degradation products (HDBP and H_2MBP) from acidified Na_2CO_3 scrub waste leaving the actinides in the aqueous phase. Dibutyl and monobutyl phosphoric acids are attached to the 2-EHOH molecules through hydrogen bonds. These hydrogen bonds also diminish the ability of the HDBP and H_2MBP to complex actinides and thus all actinides remain in the aqueous raffinate. Dilute sodium hydroxide solutions can be used to back-extract the dibutyl and monobutyl phosphoric acid esters as their sodium salts. The 2-EHOH can then be recycled. After extraction of the acidified carbonate waste with 2-EHOH, the actinides may be readily extracted from the raffinate with DHDECMP or, in the case of tetra- and hexavalent actinides, with TBP. The ARALEX process is relatively simple and involves inexpensive and readily available chamicals. The ARALEX process can also be applied to other actinide waste streams which contain appreciable concentrations of polar organic compounds that interfere with conventional actinide ion exchange and liquid-liquid extraction procedures. One such application is the removal of detergents from laundry or clean-up solutions contaminated with actinides.

14467 XRF multidetermination of Zr and Hf traces in solutions relevant to nuclear energy research. Ricci, E. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 173-174(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 13555, 14488, 14489, 14655

14468 (CONF-800402—16) Hydrides of $DyCo_3$. Kierstead, H.A. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01.

From International symposium on the properties and applications of metal hydrides; Colorado Springs, CO, USA (7 Apr 1980).

Hydrogen desorption isotherms have been measured in the system $DyCo_3H$/sub x/ for $0 \leqq x \leqq 4.25$ at temperatures of 0°, 20°, 40°, 60°, and 80°C. Pressure plateaus on the isotherms indicate the existence of two hydride phases in addition to the terminal hydrogen-saturated metal α phase. Both exhibit a wide range of solid solutions. The β phase runs from x = 1 to x = 1.83, while the γ phase runs from 3.1 to at least 4.25. The α phase is very narrow. At 20°C the plateau pressures are 3 torr and 54 torr, and the heats of absorption are -11.43 and -9.75 kcal/mole(H_2) respectively. From the temperature dependence of the isotherms, the partial molar heats and entropies of absorption and the heats and entropies of formation have been calculated as a function of x.

14469 (LBL—11760) Fluorosulfates of graphite and boron nitride and other high oxidation state studies. Biagioni, R.N. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1980. Contract W-7405-ENG-48. 135p. NTIS, PC A07/MF A01.

Thesis.

The adduct $XeF_2.AsF_5$ was re-examined and assessed to be intermediate between the salt formulation $(FXe)^+AsF_6^-$ and the fluorine bridged molecular adduct. A series of graphite fluorosulfates were prepared, using as the oxidizing agent $S_2O_6F_2$, and the effects of incorporating varying amounts of fluorosulfonic acid were studied. Physical data indicated that the $S_2O_6F_2$ was incorported as SO_3F^-, and the HSO_3F was bound tightly, probably due to hydrogen bonding. The c-spacings of HSO_3F containing materials were larger than those of acid free materials, and the influences of charging, guest size and guest orientation were examined. X-ray diffractometer studies of graphite slabs intercalated with SO_3F/HSO_3F and IrF_6 indicated structures consistent with the characterization of these materials as containing tetrahedral SO_3F and octahedral IrF_6. Boron nitride reacted with $S_2O_6F_2$ to yield a deep blue, conducting intercalation compound. This material was in many respects similar to its graphite analog, but chemically more labile.

14470 (PB—80-813421) Chemical vapor deposition. 1975-1978 (citations from the NTIS Data Base). Report for 1975-78. Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 251p. NTIS PC N01/MF N01.

This bibliography discusses chemical vapor deposition of carbon, carbides, ceramics, metals, and glasses. Applications of this

process include coatings, semiconducting films, laser materials, solar cells, composite fabrication, and nuclear reactor material fabrication. The physical, mechanical, and chemical properties of these coatings are covered. (This updated bibliography contains 246 citations, none of which are new entries to the previous edition.)

14471 **(PB—80-813439) Chemical vapor deposition. 1979-June 1980 (citations from the NTIS Data Base). Report for 1979-June 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 69p. NTIS PC N01/MF N01.

Research on chemical vapor deposition of carbon, carbides, ceramics, metals, and glasses are cited. Applications of this process include optical coatings, semiconducting films, laser materials, solar cells, composite fabrication, and nuclear reactor material fabrication. The physical, mechanical, and chemical properties of these coatings are covered. (This updated bibliography contains 64 citations, 50 of which are new entries to the previous edition.)

14472 **(SAND—80-2361C) Relationship between the properties of iron sulfides and their catalytic activity.** Stohl, F.V.; Granoff, B. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 24p. (CONF-810417—2). NTIS, PC A02/MF A01.

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Iron sulfides, such as pyrite, are known catalysts in coal liquefaction and produce significant increases in both conversion and distillate (850 F^-) yield. The main objective of this work is to increase the catalytic activity of iron sulfides by systematically changing the following properties: composition, source, particle size, surface area, morphology and defect level. Several iron sulfides have been synthesized including pyrite (FeS_2) with 46.6 wt % Fe, pyrrhotite (Fe/sub 1-x/S) with about 60 wt % Fe and mackinawite (Fe_9S_8) with 66.2 wt % Fe. The source variations have included commercial material and minerals. The pyrite particle sizes ranged from -350 to -5μm, the pyrite surface areas varied from 2 to >10 m^2/g, the mackinawite surface areas ranged from 40 to 80 m^2/g, and pyrite morphologies included massive material and a concentrate of framboids from Iowa coal. Moessbauer studies of the pyrrhotites in coal liquefaction residues have shown that there is a direct correlation between conversion and the number of vacancies in the pyrrhotite. Pyrites with enhanced defect levels were prepared by explosively shock loading Robena pyrite at 15 GPa. All these materials have been tested in either tubing reactor or autoclave runs with West Virginia Blacksville No. 2 coal and SRC-II heavy distillate (550°F^+). The runs were carried out at 425°C, 500 psi H_2 (cold charge) for 30 minutes with a 7.5 wt % catalyst loading. All these materials have shown catalytic effects as compared to uncatalyzed thermal runs.

14473 **Separation of calcium isotopes by liquid phase thermal diffusion.** Rutherford, W.M.; Laughlin, K.W. (Mound Facility, Miamisburg, OH). Contract AC04-76DP00053. *Science ;* **211**: 1054-1056(6 Mar 1981).

Significant separation of the isotopes of calcium was obtained by thermogravitational thermal diffusion of an aqueous calcium nitrate solution. A flow of solvent was used to partially offset the large solute-solvent separation effect in the experimental column. Further development of this technique may lead to separation of the isotopes of calcium and of other elements on a practical scale.

14474 **Carbon-13 chemical shifts in solid metal sandwich compounds.** Wemmer, D.E.; Pines, A. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Journal of The American Chemical Society ;* **103**: No. 1, 34-36(14 Jan 1981).

Chemical shielding parameters are reported for the metallocenes of Fe, Ru, and Mg, bis(cyclopentadionyl) complexes Cp_2TiCl_2, $(CpMe_5)_2CoCl$, and $(CpMe_5)_2Fe$, and bis(benzene)chromium. The shielding tensor anisotropy seems to reflect the character of bonding. Motion is detected in many of these compounds and has been used in some cases to assign the shielding tensor principal directions.

14475 **Low-temperature neutron diffraction studies of C-H-metal interactions in two tantalum-neopentylidene complexes: $[Ta(CHCMe_3)(PMe_3)Cl_3]_2$ [T = 110 K] and the first alkylidene/olefin complex, $Ta(eta^5\text{-}C_5Me_5)(CHCMe_3)(eta^2\text{-}C_2H_4)(PMe_3)$ [T = 20 K].** Schultz, A.J. (Argonne National Lab., IL); Brown, R.K.; Williams, J.M.; Schrock, R.R. *Journal of The American Chemical Society ;* **103**: No. 1, 169-176(14 Jan 1981).

Neutron diffraction studies of the two title compounds in which precise hydrogen atom location was essential, have established that the neopentylidene ligands are highly distorted. In $[Ta(CHCMe_3)(PMe_3)Cl_3]_2$, the Ta==C/sub α/-C/sub β/ is 161.2 (1)°, the Ta==C/sub α/-H/sub α/ angle is 84.8 (2)°, the Ta==C/sub α/ bond is short (1.898 (2) A), the C/sub α/-H/sub α/ distance is long (1.131 (3) A), and H/sub α/ angle is 78.1 (3)°, the C/sub α/-H/sub α/ bond is also long (1.135 (5) A), the Ta==C/sub α/ bond length short (1.946 (3) A), and H/sub α/ is only 2.042 (5) A from Ta. We believe the neopentylidene ligand is distorted in each case primarily because the metal is attracting electron density from the C/sub α/-H/sub α/ bond. The tantalum-ethylene bonding in the second molecule is best described as that of a tantallacyclopropane ring on the basis of the long ethylene C-C bond (1.477 (4) A) and the large angle (68.5°) between the normals to the two CH_2 planes. We believe the neopentylidene/ethylene complex does not decompose via a tantallacyclobutane complex because of the large separation between the neopentylidene and ethylene ligands.

14476 **Crystal and molecular structure of the isobacteriochlorin: (2,3,7,8-tetrahydro-5,10,15,20-tetraphenylporphinato)(pyridine)zinc(II) benzene solvate.** Barkigia, K.M.; Fajer, J.; Spaulding, L.D.; Williams, G.J.B. (Brookhaven National Lab., Upton, NY). Contract DE-AC02-76CH00016. *Journal of The American Chemical Society ;* **103**: No. 1, 176-181(14 Jan 1981).

The structure of the isobacteriochlorin, (2,3,7,8-tetrahydro-5,10,15,20-tetraphenylporphinato)(pyridine)zinc(II) benzene solvate, has been determined by three-dimensional x-ray diffraction. The compound crystallizes with one molecule each of benzene and reduced porphyrin per asymmetric unit in the triclinic space group P anti 1 with a = 11.452 (5) A, b = 13.332 (4) A, c = 14.718 (6) A, α = 99.05 (2)°, β = 94.37 (4)°, and γ = 104.88 (4)°. It is isomorphous with the corresponding chlorin, (2,3-dihydrotetraphenylporphinato)(pyridine)zinc(II) benzene solvate. The structure has been refined by least squares in three matrix blocks to R/sub F/ = 0.073, on the basis of 6217 reflections with $F_o > 0$. The results unambiguously confirm the structure, previously deduced by spectroscopic techniques, for the general class of isobacteriochlorins (and for siroheme, the prosthetic group of nitrite and sulfite reductases) as prophyrins in which two adjacent pyrrole rings are reduced. In addition, the data indicate that successive saturation of the pyrrole rings in prophyrins, chlorins, and isobacteriochlorins exerts no major effect on the stereochemistry of the macrocycles and suggest that the geometric details of high spin iron siroheme will not deviate substantially from those of iron(III) porphyrins.

14477 **Metal-hydrogen bond energies in protonated transition-metal complexes.** Stevens, A.E.; Beauchamp, J.L. (California Inst. of Technology, Pasadena). *Journal of The American Chemical Society ;* **103**: No. 1, 190-192(14 Jan 1981).

Proton affinities of 20 organotransition-metal complexes in the gas phase are reported. For 16 of these complexes protonation occurs on the metal center. The corresponding metal-hydrogen homolytic bond dissociation energies were determined and these data summarized. All proton affinities were determined by the techniques of ion cyclotron resonance spectroscopy, by examining proton-transfer reactions in mixtures with compounds of known base strength. Ionization potentials are taken from a variety of sources and experimental procedures, as noted. The site of protonation in several of these compounds has been determined by either gas-phase or solution-phase studies. These results and their interpretations are presented. (AT)

14478 Magnetic field and magnetic isotope effects in organic photochemical reactions. A novel probe of reaction mechanisms and a method for enrichment of magnetic isotopes. Turro, N.J.; Kraeutler, B. (Columbia Univ., New York). *Accounts of Chemical Research ;* **13**: No. 10, 369-377(Oct 1980).

A brief qualitative description of the theory of intersystem crossing (ISC) in radical pairs is presented. It provides a simple unified theoretical basis for understanding chemically induced nuclear polarization (CIDNP), the magnetic spin isotope effect, and magnetic field effects on chemical reactions. Examples are given in which the magnetic spin isotope effect is employed to separate ^{13}C (a magnetic isotope) from ^{12}C (a nonmagnetic isotope) more efficiently than any mechanism involving a conventional mass isotope effect, and to separate selectively ^{17}O (a magnetic isotope) from ^{16}O and ^{18}O (nonmagnetic isotope), which is impossible via a conventional mass isotope effect. Examples are also provided for which the magnetic field effect is utilized to control the efficiency of cage reactions of radical pairs. The observation of magnetic isotope and magnetic field effects on the photolysis of dibenzyl ketone in micellar solution is not an isolated finding. Numerous other ketones (phenyl adamantyl ketone, phenyl benzyl ketone, etc.) have been found to exhibit analogous behavior. The ideas discussed may be employed in principle, to design chemical reactions that will separate magnetic isotopes from their nonmagnetic colleagues. The key features are the requirement of a singlet-triplet crossing along the reaction coordinate, the availability of a hyperfine hole at the molecular geometry corresponding to the hole, and sufficient time for the representative point to find the hole when it arrives in the region of phase space corresponding to the hole. Magnetic field and magnetic isotope effects provide a complement to CIDNP for probing mechanisms of radical reactions.

14479 Application of bond length-strength analysis to 5f element fluorides. Zachariasen, W.H.; Penneman, R.A. (Los Alamos Scientific Lab., NM). *Journal of the Less-Common Metals ;* **69**: 369-377(1980).

The considerable body of single-crystal data available on 5f element fluoride structures is analyzed using Zachariasen's formula for bond lengths and bond strengths. The utility of the approach is demonstrated. Some reassignments are suggested by the analyses.

14480 Isotope effect for cation diffusion in CoO. Chen, W.K.; Peterson, N.L. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Journal of Physicks and Chemistry of Solids ;* **41**: 647-652(1980).

The simultaneous diffusion of ^{55}Co and ^{60}Co has been measured in CoO as a function of equilibrium oxygen pressure in the range $10^{-9} <$ p/sub O_2/ < 1 atm at 1200°C. The slope of the log D/sub Co/* vs log p/sub O_2/ plot changes from a value of about 1/4 at high p/sub O_2/ to about 1/5 at low p/sub O_2/ in agreement with the extensive measurements of Dieckmann. The isotope effect is independent of p/sub O_2/, which suggests that diffusion by defect clusters, interstitial Co ions and impurity-induced defects is not important in the present measurements. Conductivity, diffusion, stoichiometry and isotope-effect results are consistent with diffusion by neutral, singly charged, and doubly charged vacancies; the relative contributions from the various vacancies varies with p/sub O_2/

14481 Electronic structure of CuCl. Freeman, A.J. (Northwestern Univ., Evanston, IL); Wang, C.S. Jarlborg, T.; Weinert, M.; Wagner, F.; Chu, C.W. *International Journal of Quantum Chemistry, Symposium ;* **13**: 445-451(1979).

Self-consistent energy band structure obtained by two different ab initio methods (LCAO and LMTO) shows that CuCl is a direct gap semiconductor. No indirect gap is found at ambient or high pressures as required by Rusakov's model and Abrikosov's speculations invoking Herring's excitonium state as the origin of superdiamagnetism or high-temperature superconductivity in CuCl. Band gap predictions are compared with several existing experiments including new infrared absorption measurements we have performed and report here.

14482 Proton photoautomerism in a metal complex, determination of pK/sub a/ for a monodentate 2,2'-bipyridine complex of iridium(III). Watts, R.J.; Bergeron, S.F. (Univ. of California, Santa Barbara). Contract EY-76-S-03-0034. *Journal of Physical Chemistry, The ;* **83**: No. 3, 424-425(1979).

Tentative evidence is reported for the first observation of proton phototautomerism in a transition metal complex.

14483 (ORNL-tr—4718) Crystallization rate in supersaturated sodium sulfate solutions. Krichevskaya, Y.L. Translated from *Zhurnal Fizicheskoi Khimii ;* **19**: No. 7-8, 382-387(1945). 10p. NTIS, PC A02/MF A01.

The crystallization rate of supersaturated sodium sulfate solutions was investigated in the absence of impurities and on introduction of the following additives; sodium chloride, sulfuric acid, sodium bicarbonate, potassium sulfate, zinc sulfate, sodium and potassium acetate, sugar, and gelatin. All of the experiments were performed at a temperature of 7° and with sodium sulfate concentration of 21.95%. The crystallization rate as a function of temperature is characterized by the presence of a maximum and a minimum, the positions of which depend on the concentration of the solution. With significant supercooling the crystallization rate does not depend on the temperature and supersaturation, and it becomes directly proportional to the square of the solution concentration. With low supersaturation (less than 12 to 14%) the limiting stage is diffusion, and the crystallization rate depends only on the concentration difference of the supersaturated and saturated solutions. Variation of the viscosity of the solution and dismeter of the vessel has no influence on the crystallization rate. A study made on the effect of adding salts showed that the greatest increase in the linear crystallization rate was caused by sodium acetate. The crystallization rate depends on the pH of the solution, increasing with a decrease in the pH.

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14484 (AD-A—087802) Collisional relaxation of vibrational energy transients in the methylcyclopropane system. A variable encounter method study. Technical report. Kelley, D.F.; Kasai, T.; Rabinovitch, B.S. (Washington Univ., Seattle (USA). Dept. of Chemistry). 1 Aug 1980. 27p. (TR—16). NTIS, PC A03/MF A01.

The Variable Encounter Method has been used to study vibrational energy transients in the isomerization of methylcyclopropane to various butenes. This system was studied with reactor surface temperatures of 800 K to 1130 K and average numbers of collisions per encounter with the reactor of 5.6 and 20.0. The reaction rate was treated on the basis of total, rather than individual butene rates, because of butene product interconversion. An exponential model of energy transfer was found to give the best fit to the data with the average down step energy <delta E prime> decreasing from 1860/cm to 1415/cm with increase of temperature over the range studied. Incubation times increased from 14 to 19 collisons with increase in temperture, and these times together with valves of the conventional relative collision efficiency Beta and values of <delta E prime>, are compared with those of other molecules studied by VEM. The calculated transient population distributions and the associated sequential reaction probabilities are also displayed.

14485 Transferable intermolecular potential functions for water, alcohols, and ethers. Application to liquid water. Jorgensen, W.L. (Purdue Univ., West Lafayette, IN). *Journal of The American Chemical Society ;* **103**: No. 2, 335-340(28 Jan 1981).

Transferable intermolecular potential functions (TIPS) suitable for use in liquid simulation are reported for water, alcohols, and ethers. Interaction sites are located on oxygens, hydroxyl hydrogens, and the carbons in alkyl groups. Each type of site has Coulomb and Lennard-Jones parameters chosen to yield reasonable structural and energetic results for both gas-phase dimers and pure liquids. A Monte Carlo simulation of liquid water at 25°C using the TIP potential compares favorably with experiment or results from Clementi's CI potential except that the OO radial distribution function is calculated to be too flat beyond the first solvent shell. Simu-

lations of liquid methanol and ethanol have also been carried out as described in the accompanying papers. Overall, in view of the simplicity and transferability of the potentials, the initial results are most encouraging for the treatment of fluids with even more complex monomers and for extension to other types of interaction sites.

14486 **Transferable intermolecular potential functions. Application to liquid methanol including internal rotation.** Jorgensen, W.L. (Purdue Univ., West Lafayette, IN). *Journal of The American Chemical Society ;* **103**: No. 2, 341-345(28 Jan 1981).

Two transferable intermolecular potential functions for the methanol dimer have been used in Monte Carlo statistical mechanics simulations of liquid methanol at 25°C. One function employs the three-site TIP model for a monomer, while the other retains the methyl hydrogens explicitly in a six-site model. The sampling with the latter potential included the internal rotation for the first time in a Monte Carlo calculation. It is found that the liquid's structure does not alter the dihedral angle distribution from the gas-phase result. Both functions show improved agreement with experimental thermodynamic and structural data in comparison to a previous simulation based on a potential function derived from quantum mechanical calculations. The success of the simple TIP model indicates that treating the methyl hydrogens implicitly is reasonable. Winding hydrogen bonded chains dominate the liquid's structure. Most monomers participate in one or two hydrogen bonds which are bent an average of 20°.

14487 **Simulation of liquid ethanol including internal rotation.** Jorgensen, W.L. (Purdue Univ., West Lafayette, IN). *Journal of The American Chemical Society ;* **103**: No. 2, 345-350(28 Jan 1981).

A Monte Carlo statistical mechanics simulation of liquid ethanol at 25°C has been performed by using the TIP model to describe the intermolecular interactions. Detailed structural and thermodynamic information has been obtained and compares favorably with experimental results including x-ray and infrared data. The internal rotation about the CO bond in the monomers was included in the calculations. The liquid's structure was not found to alter significantly the distribution for the dihedral angle from the ideal gas result. Winding hydrogen-bonded chains are ubiquitous in the liquid, and some branching of the chains is evident. Smaller oligomers are also present, though the occurrence of cyclic multimers is relatively uncommon. The monomers in the liquid experience an energetic continuum of environments covering a 20-kcal/mol range. Furthermore, the hydrogen bonds are distributed in both energy and geometry with the average hydrogen bond bent 15 to 20° from linear. The overall success of the simulation emphasizes the value and utility of the TIP based approach to modeling fluids.

14488 **NMR study of molecular reorientation under fivefold symmetry: solid permethylferrocene.** Wemmer, D.E.; Ruben, D.J.; Pines, A. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Journal of The American Chemical Society ;* **103**: No. 1, 28-33(14 Jan 1981).

The ring reorientation in permethylferrocene has been studied by using high-resolution solid-state ^{13}C NMR. The constraints which symmetry places upon the number and types of motional parameters which may be determined from the NMR spectrum are discussed. From comparison of the experimental line shapes in the slow reorientation temperature range with theoretical models for random rotations and symmetry-related jumps, it is concluded that the reorientation occurs as jumps between symmetry-related orientations with jumps of $2\pi/5$ highly favored over $4\pi/5$. The activation energy derived for the jump process is 13.5 kJ/mol.

14489 **High methane formation during the temperature-programmed decomposition in flowing hydrogen of supported mononuclear and polynuclear carbonyl complexes.** Hucul, D.A.; Brenner, A. (Wayne State Univ., Detroit, MI). *Journal of The American Chemical Society ;* **103**: No. 1, 217-219(14 Jan 1981).

This paper presents the first detailed study of the temperature-programmed decomposition (TPDE) in flowing hydrogen of every element which forms a stable carbonyl. The investigation shows that these systems have an unexpectedly high propensity to form methane. The parameters affecting the yield of methane are described and this stoichiometric reaction is compared to catalytic methanation. (AT)

14490 **Theoretical studies on the reaction of atomic oxygen (^3P) with acetylene.** Harding, L.B. (Argonne National Lab., IL). *Journal of Physical Chemistry, The ;* **85**: No. 1, 10-11(8 Jan 1981).

Ab initio, configuration interaction calculations with a polarization, double-zeta basis set are reported on the barriers to decomposition of triplet formylmethylene. It is found that the barrier to hydrogen atom elimination is 37 kcal/mol while that to 1,2 hydrogen migration is 53 kcal/mol. On the basis of these results it is concluded that the dominant products resulting from the reaction of $O(^3P)$ with acetylene should be atomic hydrogen and the HCCO radical.

14491 **Vapor pressures of 17 miscellaneous organic compounds.** Osborn, A.G.; Scott, D.W. (Dept. of Energy, Bartlesville, OK). *Journal of Chemical Thermodynamics, The ;* **12**: 429-438(1980).

Experimental vapor pressures are reported for 3,3-diethylpentane, methylenecyclobutane, ethylbenzene, biphenylene, 1,2-diphenylethane, trimethylene oxide, 1,2-epoxybutane, trans-2,3-epoxybutane, 1,3-difluorobenzene, 1,4-difluorobenzene, methanethiol, 2,2,4,4-tetramethyl-3-thiapentane, phenylmethanethiol, 2-isopropylthiophene, ethyleneimine, cyclopropylamine, and isobutylamine.

14492 **(4RS,5SR)-2,5-Di-tert-butyl-4,5-dihydroxy-4-methyl-2-cyclopenten-1-one, an unusual product of oxidation of 2,6-Di-tert-butyl-4-methylphenol.** Brown, G.M. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Acta Crystallographica, Section B. Structural Crystallography and Crystal Chemistry ;* **35**: 2779-2781(1979).

$C_{14}H_{24}O_3$, orthorhombic, $Pna2_1$, a = 21.171 (3), b = 10.415 (2), c = 6.359 (1) A [at 295 to 297 K, based on λ (Cu Kα) = 1.5418 A], Z = 4, p/sub calc/ = 1.105 Mg m^{-3}; structure based on 1278 $/F_o/^2$ values, R(F) = 0.029, R(F^2) = 0.042, σ_1 = 1.547. X-ray analysis has identified the compound and specified the relative stereochemical configuration. The cyclopentene ring has the envelope conformation, atom C(5) defining the flap. Bond C(4)-C(5) is abnormally long, 1.574 (2) A, and angles O(4)-C(4)-C(5) and C(11)-C(5)-C(4) are abnormally large, 116.5(1) and 117.0(1)° respectively; these features are consistent with the fact that the conformation around ring bond C(4)-C(5) is only ~ 26.5° from eclipse, which implies considerable repulsion, especially between the 4-hydroxyl and 5-tert-butyl groups. The bond to the 5-tert-butyl group is also long, 1.576 (3) A. Two kinds of H-bonds, one bifurcated (intra- and intermolecular) and very weak, join the molecules into ribbons two-molecules wide running parallel to c and held together in a herringbone pattern by van der Waals forces.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 14131

14493 **Electrode-supported oxidation catalyst based on ruthenium(IV). pH encapsulation in a polymer film.** Samuels, G.J.; Meyer, T.J. (Univ. of North Carolina, Chapel Hill). *Journal of The American Chemical Society ;* **103**: No. 2, 307-312(28 Jan 1981).

The known oxidative catalytic behavior of the ions $(bpy)_2(py)RuO^{2+}$ (bpy is 2,2'-bipyridine; py is pyridine) and (trpy)(bpy)RuO^{2+} (trpy is 2,2',2"-terpyridine) has been successfully transferred to electrode surfaces. The electrodes were chemically modified by deposition of thin polymeric films containing the $(bpy)_2(H_2O)$Ru/sup II/ group bound to poly-4-vinylpyridine. Upon oxidation to Ru/sup IV/ on the surface catalytic oxidation currents are observed for the modified electrodes in the presence of 2-propanol, p-toluic acid, and the xylenes with an added surfactant. The effective catalytic lifetimes of the films are limited (> 30 turnovers per redox site) by a competing reaction within the polymer film which changes the nature of the redox sites. An unusual pH effect has been observed in the polymer films. Below pH 4, potentials measured by cyclic voltammetry for the bound $[(bpy)_2(OH)$Ru/sup

II/(py)-]$^{3+}$/[(bpy)$_2$(OH$_2$)Ru/sup III/(py)-]$^{3+}$ and [(bpy)$_2$(O)Ru/sup IV/(py)-]$^{3+}$/[(bpy)$_2$(OH)Ru/sup III/(py)-]$^{3+}$ couples change with pH as expected. Above pH 4, where the unbound pyridyl groups in the polymer become deprotonated, up to pH 9.2 the redox couples no longer respond to pH changes in the bulk solution. The difference in pH behavior between the polymer in solution and on the electrode surface has allowed us to observe the deposition process by cyclic voltammetry. In acid solution, the polymer film is open and large amounts of ferri- or ferrocyanide ions can be incorporated reversibly into the films by ion exchange. Over a longer time period, the cyano ions are permanently bound in the films, apparently by the formation of a cyano-bridged Fe-Ru dimer.

14494 **Transient behavior of porous electrodes with high exchange current densities.** Pollard, R.; Newman, J. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Electrochimica Acta ;* **25**: 315-321(1980).

A theoretical analysis of the non-steady-state reaction distribution in a porous electrode with a high exchange current density is made by application of a simplified macrohomogeneous model for porous electrodes. The dimensionless transfer current for short times is given as an expansion in time, and two terms in a moderate time solution are also presented. At moderate times the current is split into time-dependent and time-independent parts, but this distinction is not apparent in the short time solution. For the limiting case of reversible kinetics, the analysis specifies the fraction of the superficial current density that will be distributed through the electrode. Treatments for the PbO_2 and LiAl electrodes are presented as examples.

14495 **Theory of the potential and voltage step relaxation techniques for the investigation of fast electrode reactions.** Nagy, Z. (Argonne National Lab., IL). Contract W-31-109-ENG-38. *Electrochimica Acta ;* **25**: 575-581(1979).

The errors of electrode kinetic measurements carried out with the potential and voltage step techniques (for single and double pulses) are calculated for several graphical and numerical data analysis methods. The following errors are examined: the random, experimental errors caused by the uncertainties of the potential, current, time, electrode area, and ir compensation; and the systematic errors caused by the inadequacies of the mathematical treatments and by the neglect of the slow rise time of a real potentiostatic system. The errors are presented as a function of the reaction resistance and of the rate constant parameter. The latter, which is defined as [R/sub r//(Ar/sub t/ + R/sub r/)] . (i_0/vnF)(1/D_0/sup 1/2/C_0 + 1/D/sub R/sup 1/2/C/sub R/), is equal to 632k_0 under simplified conditions. For a maximum tolerable error of +- 20 per cent in the determination of the exchange current density, the limitation of the techniques can be summarized as follows. The classical potentiostatic technique with exact ir compensation can be used to a rate constant parameter of about 200 ($k_0 \approx 0.3$ cm s^{-1}). The useful range can be extended to about 1000 ($k_0 \approx 1.5$ cm^{-1}) by using a numerical data evaluation method which takes into consideration the rise time of the potential. For the voltage step technique and the potentiostatic technique with uncompensated resistance, the limits of applicability can be significantly lower than the above values, depending on the ratio of reaction resistance to total cell resistance.

4005 Photochemistry

14496 **(LBL—12213) Competing reaction channels in IR-laser-induced unimolecular reactions.** Berman, M.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1981. Contract W-7405-ENG-48. 248p. NTIS, PC A11/MF A01.

Thesis.

The competing reaction channels in the unimolecular decomposition of two molecules, formaldehyde and tetralin were studied. A TEA CO_2 laser was used as the excitation source in all experiments. The dissociation of D_2CO was studied by infrared multiphoton dissociation (MPD) and the small-molecule nature of formaldehyde with regard to MPD was explored. The effect of collisions in MPD were probed by the pressure dependence of the MPD yield and ir fluorescence from multiphoton excited D_2CO. MPD yield shows a near cubic dependence in pure D_2CO which is reduced to a 1.7 power dependence when 15 torr of NO is added. The peak amplitude of 5 μm ir fluorescence from D_2CO is proportional to the square of the D_2CO pressure in pure D_2CO or in the presence of 50 torr of Ar. Results are explained in terms of bottlenecks to excitation at the v = 1 level which are overcome by a combination of vibrational energy transfer and rotational relaxation. The radical/molecule branching ratio in D_2CO MPD was 0.10 +- 0.02 at a fluence of 125 J/cm^2 at 946.0 cm^{-1}. The barrier height to molecular dissociation was calculated to be 3.6 +- 2.0 kcal/mole below the radical threshold or 85.0 +- 3.0 kcal/mole above the ground state of D_2CO. In H_2CO, this corresponds to 2.5 +- 2.0 kcal/mole below the radical threshold or 83.8 +- 3.0 kcal/mole above the ground state. Comparison with uv data indicate that RRKM theory is an acceptable description of formaldehyde dissociation in the 5 to 10 torr pressure range. The unimolecular decomposition of tetralin was studied by MPD and SiF_4 - sensitized pyrolysis. Both techniques induce decomposition without the interference of catalytic surfaces. Ethylene loss is identified as the lowest energy reaction channel. Dehydrogenation is found to result from step-wise H atom loss. Isomerization via disproportionation is also identified as a primary reaction channel.

14497 **Kinetics of free radicals produced by infrared multiphoton-induced decompositions. 1. Reactions of allyl radicals with nitrogen dioxide and bromine.** Slagle, I.R.; Yamada, F.; Gutman, D. (Illinois Inst. of Tech., Chicago). Contract AS02-78ER14593. *Journal of The American Chemical Society ;* **103**: No. 1, 149-153(14 Jan 1981).

A new versatile technique to study quantitatively the gaseous reactions of polyatomic free radicals is described in detail. Free radicals are generated homogeneously in a tubular reactor by the infrared multiphoton-induced decomposition (MPD) of suitable radical precursors. The concentrations of reactants and products (both stable and labile) are monitored by using photoionization mass spectrometry. Reactions of the allyl radical, generated by the MPD of allyl bromide, with nitrogen dioxide and bromine have been studied at 300°K. The measured rate constants are 3.9 (+-0.8) x 10^{-11} cm^3 s^{-1} for the C_3H_5 + NO_2 reaction and 9.0 (+-1.8) x 10^{-12} cm^3 s^{-1} for the C_3H_5 + Br_2 reaction. The potential of the experimental facility for other kinds of studies is discussed.

14498 **Photoionization measurement of the triplet lifetime of benzene.** Duncan, M.A.; Dietz, T.G.; Liverman, M.G.; Smalley, R.E. (Rice Univ., Houston, TX). *Journal of Physical Chemistry, The ;* **85**: No. 1, 7-9(8 Jan 1981).

The lifetime of triplet benzene produced by laser excitation of the 6^1 level of the S_1 state in a supersonic beam has been measured by photoionization with an ArF excimer laser. This collision-free lifetime pertaining to the vibrationally unrelaxed triplet was found to be 470 +- 50 ns. Measurement of a component of the photoion signal due to decay of S_1 permitted, in addition, an estimate of the quantum yield for intersystem crossing.

14499 **Photoconductivity studies of the ferrocyanide ion under high pressure.** Finston, M.I.; Drickamer, H.G. (Univ of Illinois, Urbana). *Journal of Physical Chemistry, The ;* **85**: No. 1, 50-55(8 Jan 1981).

An apparatus was developed for the investigation of photoconductivity phenomena in liquids pressurized to 10 kbar. The photoaquation of the ferrocyanide ion was studied by use of the high-pressure photoconductivity apparatus and a steady-state high-pressure mercury lamp. The first-order photocurrent rise time could be related to the relative quantum efficiency of the photoaquation process, while the dark decay of the photocurrent yielded a relative value of the bimolecular rate constant for the reverse reaction. Kinetic measurements were carried out on dilute solutions of potassium ferrocyanide in pure water, and in 20% ethanol. The photocurrent yield in aqueous solution was dependent upon secondary chemical equilibria which were sensitive to pressure in a predictable way. In ethanolic solution, the dependence of photocurrent yield on pressure followed the variation of the reciprocal solvent viscosity. In both aqueous and alcoholic solution, the photoaquation quantum, efficiency decreased exponentially with pressure, as did the bimolecular rate constant for the dark reaction in aqueous solution. The pressure dependence of the bimolecular rate constant in the alcoholic solution indicated a diffusion-limited process. The

pressure dependence of the photoaquation quantum yield, and of the bimolecular rate constant in aqueous solution, was interpreted in terms of an activation volume model. The activation volumes of photoaquation range from 7.5 to 9 cm^3/mol at 8-10 kbar. For the recombination process the activation volume was 13-14 cm^3/mol. The photoaquation data for both the aqueous and the alcoholic solutions agreed with a hypothetical mechanism whereby ligand-to-metal bond breaking and solvent-to-metal bond formation are effectively simultaneous. The results for the aqueous dark reaction strongly indicated breaking of the solvent-to-metal bond as the rate-limiting step.

14500 **Resonantly enhanced multiphoton ionization of xenon: photoelectron energy analysis.** Compton, R.N. (Oak Ridge National Lab., TN); Miller, J.C.; Carter, A.E.; Kruit, P. Contract W-7405-ENG-26. *Chemical Physics Letters ;* **71**: No. 1, 87-90(1 Apr 1980).

Photoelectron energy distributions resulting from multiphoton ionization of Xe through the 6s, 6s', and 5d levels are reported. Ionization via the 6s state leaves Xe^+ approximately equally in the ^2P/sub 3/2/ and ^2P/sub 1/2/ final states, as opposed to the $\approx$ 1.6: 1 branching ratio observed in single photon ionization.

14501 **Photochemistry of high-spin iron(III) complexes of the macrocyclic ligands [15]pydieneN$_5$ and [15]pyaneN$_5$. An investigation of the charge-transfer processes.** Ferraudi, G. *Inorganic Chemistry ;* **19**: 438-444(1980).

The charge-transfer photochemistries of iron(III) complexes of the [15]pydieneN$_5$ and [15]pyaneN$_5$ ligands were investigated in nonaqueous media. The photochemical reactivity, exhibited by these compounds, can be described as a reduction of the metal center with a concurrent oxidation of axially coordinaed ligands - Cl^-, Br^-, N_3^-, NCS^-, I^-. Intermediates, produced in these reactions, were investigated by flash photolysis and intercepted with appropriate scavengers. Threshold energies for photochemical reactivity obtained for Fe([15]pydieneN$_5$)(X)$_2^+$(X: Cl^-, Br^-, N_3^-, NCS^-) and Fe([15]pyaneN$_5$)(X)$_2^+$(X: Cl^-, Br^-, N_3^-) exhibited a large dependence on both the macrocyclic and the axially coordinated ligands.

14502 **Rate constant for the reaction of OH with HO_2.** Lii, R.R.; Gorse, R.A. Jr.; Sauer, M.C. Jr.; Gordon, S. (Argonne National Lab., IL). *Journal of Physical Chemistry, The ;* **84**: No. 8, 819-821(1980).

Spectrophotometric observation of both HO_2 and OH in pulse-irradiated Ar-H_2O-O_2 systems leads to a value of k_3 = (0.99 +- 0.12) x 10^{-10} cm^3 $molecule^{-1}s^{-1}$ at 308 K for the reaction $OH + HO_2 \rightarrow H_2O + O_2$.

14503 **Interaction between photogenerated biradicals and free radicals: di-tert-butylnitroxide.** Encinas, M.V.; Scaiano, J.C. (Univ. of Notre Dame, IN). *Journal of Photochemistry ;* **11**: 241-247(1979).

Di-tert-butylnitroxide interacts with the biradicals produced in the photochemistry of γ-methylvalerophenone with a rate k/sub s/ of 1.2 x 10^9 M^{-1} s^{-1} in benzene. This process leads to a change in the mode of biradical partition, which should be attributed to biradical-di-tert-butylnitroxide interactions which reflect spin selection rules.

14504 **Solid state photochemistry of aziridines and oxiranes.** Trozzolo, A.M. (Univ. of Notre Dame, IN); Sarpotdar, A.S.; Leslie, T.M.; Hartless, R.L.; Dominh, T. *Molecular Crystals and Liquid Crystals ;* **50**: 201-212(1979).

The solid-state photolysis of oxiranes and aziridines produces highly colored ylide intermediates. The stability of these intermediates is dependent on a combination of electronic and steric factors as well as the solid-state constraints of the environment. By the use of certain gas-solid reactions, it is possible to control the lifetime of the intermediate so that it is destroyed immediately or continues to exist almost indefinitely. The anisotropic aspects of the reaction as well as the spectral properties of the intermediates are discussed.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 13496

14505 **Radiation-induced cationic polymerization of β-pinene.** Adur, A.M.; Williams, F. (Univ. of Tennessee, Knoxville). *Journal of Polymer Science, Polymer Chemistry Edition ;* **19**: No. 3, 669-678(Mar 1981).

The radiation-induced polymerization of β-pinene carried out in bulk at ca.25° has been studied for different methods of monomer drying. It has been confirmed that the polymerization is sensitive to adventitious moisture and that substantial polymer yields (ca. 10% conversion per Mrad) can only be obtained under extremely dry conditions. Complete inhibition of the reaction by added tripropylamine corroborates the view that the polymerization is cationic. About half of the polymer formed is insoluble in the monomer. The number-average molecular weights for the soluble poly(β-pinene) fraction have been measured by vapor pressure osmometry and are in the narrow range from 1700 to 2400 with little or no dependence on the degree of monomer conversion to polymer, at least up to 80%. The results are compared with literature reports on the polymerization of β-pinene by catalytic initiators.

14506 **Theoretical models for solvated electrons.** Feng, D.F.; Kevan, L. (Wayne State Univ., Detroit, MI). Contract EY-76-02-S-2086. *Chemical Reviews ;* **80**: No. 1, 1-20(Feb 1980).

This is a review of theoretical models that have been advanced to describe solvated electrons in disordered systems. The following four groups of models discussed: molecular orbital which includes dimer, tetramer and pentamer models; molecular field model; continuum model; dipole orientation model; and semicontinuum model. The CKJ and FFK semicontinuum model appears to be a reasonably successful theoretical model for treating the energy level structure of solvated electrons. It is particularly useful because it is simple enough to apply to a wide variety of solvent systems at different temperatures and pressures. It is successful at predicting many experimental trends. Nevertheless, the model has demonstrated defects both in the potential and in the wave functions used. The potential is too long range and the wave functions are too diffuse. It is necessary to use the ab initio semicontinuum model to study the geometrical structure of solvated electrons. Since good experimental data now exist for solvated electrons in, at least, water and ethanol with greatly contrasting geometries, it is possible to test the success of the ab initio model for treating geometry. However, the ab initio modification of the CKJ and FFK semicontinuum model makes it expensive and time consuming to apply. The semicontinuum model is notably unsuccessful in treating the optical absorption band shape. A number of other models have been proposed, some of which claim successful fits. In all cases it appears that some contribution from bound-continuum transitions must be invoked. This seems consistent with experiment. However, none of the theories have yet been able to give a clear physical basis for the observed line shape.

14507 **Rate constant of the reaction of O(^{3}P) with HO_2.** Ruey-Rong, L.; Sauer, M.C. Jr.; Gordon, S. (Argonne National Lab., IL). *Journal of Physical Chemistry, The ;* **84**: No. 8, 817-819(1980).

The rate constant for the reaction of O(^{3}P) with HO_2 is measured at 298 K by spectrophotometric observation of the HO_2 decay (230 nm) and the O_3 formation (265 nm) following irradiation of systems of ca. 3.6 x 10^{18} molecules of Ar cm^{-3}, 6.5 x 10^{18} molecules of H_2 cm^{-3}, and 1.6 x 10^{18}-6.5 x 10^{18} molecules of O_2 cm^{-3} with electron pulses. The rate constant obtained is (7 +- 2) x 10^{-11} cm^3 $molecule^{-1}s^{-1}$.

14508 **Temperature dependence of the gas-phase self-reaction of HO_2 in the presence of NH_3.** Lii, R.R.; Gorse, R.A. Jr.; Sauer, M.C. Jr.; Gordon, S. (Argonne National Lab., IL). *Journal of Physical Chemistry, The ;* **84**: 813-817(1980).

The dependence of the rate constant for the overall reaction $HO_2 + HO_2 \rightarrow$ products on temperature (290 to 400 K) and concentration of NH_3 is reported. Analysis of the results yields values

of $\Delta H^{\circ}_{298} = 13 +- 1.5$ kcal/mol and $\Delta G^{\circ}_{298} = 3.3 +- 0.2$ kcal/mol for the formation of the HO_2-NH_3 complex.

14509 Radiation Research. Okada, S.; Imamura, M.; Terashima, T.; Yamaguchi, H. (eds.). Tokyo, Japan; Japanese Association for Radiation Research (1979). 1027p. (CONF-790524—).

From 6. international congress symposium on radiation research and stem cells; Tokyo, Japan (13 May 1979).

This volume contains 111 papers presented at the meeting. Twelve of these have already been cited in ERA, and can be located by reference to CONF-790524— in the Report Number Index. The remaining papers will be added to the data base as they are received from INIS. (RWR)

4007 Radiochemistry And Nuclear Chemistry

14510 (CONF-810126—1) Fission-fragment attachment to aerosols and their transport through capillary tubes. Novick, V.J.; Alvarez, J.L.; Greenwood, R.C. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 25p. NTIS, PC A02/MF A01.

From ACS/IEC winter symposium on aerosol systems; Tucson, AZ, USA (26 Jan 1981).

The transport of radioactive aerosols was studied using equipment, collectively called the Helium jet, that has been constructed to provide basic nuclear physics data on fission product nuclides. The transport of the fission products in the system depends on their attachment to aerosol particles. The system consists of 1) a tube furnace which generates aerosols by the sublimation or evaporation of source material, 2) a helium stream used to transport the aerosols, 3) a 25 m settling tube to eliminate the larger aerosols and smaller aerosols that would deposit in the capillary, 4) a Californium-252 self-fissioning source of fission product nuclides, and 5) a small capillary to carry the radioactive aerosols from the hot cell to the laboratory. Different source materials were aerosolized but NaCl is generally used because it yielded the highest transport efficiencies through the capillary. Particle size measurments were made with NaCl aerosols by using a cascade impactor, an optical light scattering device, and the capillary itself as a diffusion battery by performing radiation measurements and/or electrical conductivity measurements. Both radioactive and nonradioactive aerosols were measured in order to investigate the possibility of a preferential size range for fission product attachment. The measured size distributions were then used to calculate attachment coefficients and finally an attachment time.

14511 (ORO—4447-119) Physical-chemical studies of transuranium elements. Progress report, April 1, 1980-March 31, 1981. Peterson, J.R. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1981. Contract AS05-76ER04447. 36p. NTIS, PC A03/MF A01.

Major advances in our continuing program to determine, interpret, and correlate the basic chemical and physical properties of the transuranium elements are summarized for the period April 1, 1980 through March 31, 1981.

14512 Direct formation of RCl from the gas-phase reaction of thermal atomic chlorine with PbR_4 (R = CH_3, C_2H_5). Kikuchi, M.; Lee, F.S.C.; Rowland, F.S. (Univ. of California, Irvine). *Journal of Physical Chemistry, The ;* **85**: No. 1, 84-88(8 Jan 1981).

The reactions of chlorine atoms with $Pb(CH_3)_4$ have been studied in the gas phase at 20°C and 500 to 5000 torr pressure, using ^{38}Cl atoms thermalized by multiple collisions with CCl_2F_2 after formation by the nuclear reaction $^{37}Cl(n, \gamma)^{38}Cl$. Approximately 18% of the ^{38}Cl atoms react with $Pb(CH_3)_4$ by a direct bimolecular substitution mechanism to form $CH_3{}^{38}Cl$, as in (1): $^{38}Cl + Pb(CH_3)_4 \rightarrow CH_3{}^{38}Cl + Pb(CH_3)_3$(1). The formation of $C_2H_5{}^{38}Cl$ is observed for thermal ^{38}Cl reaction with $Pb(C_2H_5)_4$: $^{38}Cl + Pb(C_2H_5)_4 \rightarrow C_2H_5{}^{38}Cl + Pb(C_2H_5)_3$(2). About 5% of the ^{38}Cl atoms undergo hot substitution reaction with CCl_2F_2, and the remaining ^{38}Cl atoms (> 75%) presumably react chiefly by abstraction of H from PbR_4, as in (3): $^{38}Cl + Pb(CH_3)_4 \rightarrow H^{38}Cl + (CH_3)_3PbCH_2$(3). The relative rates of reactions 1 and 3 have been measured in competition with addition to C_2H_4 and C_2H_2, and the absolute reaction rates estimated from the known rates of the addition reactions. The rate constants are $k_1 = (3.0 +- 0.5) \times 10^{-11} cm^3$ molecule $^{-1}s^{-1}$ and $k_3 = (1.3 +- 0.3) \times 10^{-10} cm^3$ molecule$^{-1}s^{-1}$. The reactivity towad H abstraction is approximately the same per C-H bond for reaction with $Pb(CH_3)_4$ and C_2H_6. The reaction rates with $Pb(C_2H_5)_4$ appear to be even faster than with $Pb(CH_3)_4$ for both the substitution and abstraction process.

14513 Gas-phase reactions of thermal fluorine-18 with propyne and 3,3,3-trifluoropropyne. Concannon, C.; Rowland, F.S. (Univ. of California, Irvine). *Journal of Physical Chemistry, The ;* **85**: No. 1, 89-94(8 Jan 1981).

The radicals formed by addition of ^{18}F to alkyne substrates are converted to stable alkenes by reaction with a hydrogen-donor molecule such as H_2Se or HI and assayed by radiogas chromatography. The terminal/central addition ratio for ^{18}F with $CH_3C{=}{=}CH$ is 2.6 +- 0.2, and with $CF_3C{=}{=}CH$ it is 3.7 +- 0.2. The terminal/central reaction ratio is probably controlled chiefly by the thermochemical stability of the incipient radical, since the electron densities of the α- and β-carbon atoms in $CF_3C{=}{=}CH$ are quite similar. The cis/trans ratio of the isomeric $CH_3CH{=}{=}CH^{18}F$ molecules formed by terminal attack of ^{18}F on $CH_3C{=}{=}CH$ is 2.1 +- 0.1, which is the thermochemical equilibrium ratio at about 220 to 250°C. The trans/cis ratio of $CF_3CH{=}{=}CH^{18}F$ isomers after thermal ^{18}F attack on $CF_3C{=}{=}CH$ is 7.1 +- 0.5, which is the thermochemical equilibrium ratio for these molecules at about 200 to 250°C. The $CX_3C{=}{=}CH^{18}F$ radical precursors in each system presumably are able to isomerize until sufficient internal energy is removed, and the existing cis/trans equilibrium among the radicals is then frozen in during the remainder of the radical thermalization process. Approximately 33 +- 3% of the thermal ^{18}F atoms react with $CH_3C{=}{=}CH$ by abstraction of H, while the remainder add to the π-bond system. Approximately 14 +- 3% of the thermal ^{18}F atoms react by abstraction with $CF_3C{=}{=}CH$, with the rest reacting by addition. No reverse loss of ^{18}F from either $C_3H_4{}^{18}F^{\bullet}$ or $C_3HF_3{}^{18}F^{\bullet}$ was observed, with an upper limit on the half-stabilization pressure for each of about 50 torr of SF_6. The rate constant for thermal addition to $CF_3C{=}{=}CH$ is (6.0 +- 0.6) x $10^{-11} cm^3$ molecule $^{-1}s^{-1}$ at 10°C, which is about (2.9 +- 0.5) times slower than addition to C_2H_2. Addition to $CH_3C{=}{=}CH$ occurs with approximately the same rate constant as addition to C_2H_2.

14514 Adsorption of Cs(I), Sr(II), Eu(III), Co(II), and Cd(II) by Al_2O_3. Shiao, S.Y.; Egozy, Y.; Meyer, R.E. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 123-124(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14515 (DOE/EV/04078—T1) Interactive radiopharmaceutical facility between Yale Medical Center and Brookhaven National Laboratory. Progress report, November 1, 1980-October 31, 1981. Gottschalk, A. (Yale Univ., New Haven, CT (USA). School of Medicine). [nd]. Contract AS02-76EV04078. 32p. NTIS, PC A03/MF A01.

Research conducted in three principal areas is discussed and summarized. (1) Investigation of the influence of antiarrhythmic agents, such as lidocaine and procainamide, on the chemotaxis and nylon fiber adherence of indium-111-labelled human polymorphonulcear leukocytes (PMNs) in vitro revealed that at normal therapeutic levels of lidocaine and procaine, the adherence and chemotactic function of In-111-PMNs remain unaltered. Results with higher therapeutic blood levels are also discussed. (2) An improved method for labeling human platelets with In-111-oxine is outlined, and the influence of centrifugal force, oxine, ethanol, and radiation on platelet function is reported. Results indicate that normal labeling procedures induce no gross changes in platelet function. (3) The chemical preparation of radioiodinated arachidonic acid (AA) and nonradioactive acid ester of AA, and the analysis of metabolites of these compounds following myocardial ischemia were investigated in dogs. The tissue uptake of ^{131}I-AA was compared to that of thallium-201.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 13359, 13360, 13361, 13364, 14588, 14878

14516 (DOE/PC/30292—1) Synthetic fuel combustion: pollutant formation. Soot initiation mechanisms in burning aromatics. First quarterly report, 19 September-31 December 1980. Rawlins, W.T.; Tanzawa, T. (Physical Sciences, Inc., Woburn, MA (USA)). Jan 1981. Contract AC22-80PC30292. 33p. (PSI-TR—255). NTIS, PC A03/MF A01.

Although considerable progress has been made in recent years in understanding the phenomenology of soot formation in the combustion of hydrocarbon fuels, relatively little attention has been focused upon aromatic fuels of the types commonly found in coal liquids. In particular, the effects of gas-phase free radicals, formed during combustion, on the kinetics of formation of incipient soot particles have not been characterized. Accordingly, an experimental investigation of the detailed kinetics of incipient soot formation in the combustion and pyrolysis of aromatic fuels of the benzene, anisole, phenol, and pyrrole families has been initiated in order to determine soot formation mechanisms and rate parameters. The experiments will be performed in a shock tube over the temperature range 1300 to 2500 K, using multiple ultraviolet, visible, and infrared diagnostics to monitor the kinetic behavior of free radicals (such as OH), incipient soot particles, and combustion products. Experiments will be conducted with artificially enhanced concentrations of free radicals such as OH and O to determine their effects on the kinetics of soot and soot precursors. The experimental work will be supported and directed by a parallel analytical effort using a detailed mechanistic model of the chemical kinetics and dynamics of the reacting systems. In this report, the design and configuration of the experimental apparatus are described, the details of the kinetic model are outlined, and possible reaction pathways are discussed.

14517 (SAND—80-8623) Laser Rayleigh thermometry in turbulent flames. Dibble, R.W.; Hollenbach, R.E. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1981. Contract AC04-76DP00789. 27p. (CONF-800809—7). NTIS, PC A03/MF A01.

From 18. combustion symposium; Waterloo, Canada (17 Aug 1980).

Nonintrusive, spatially and temporally resolved temperature measurements in turbulent flames, premixed and non-premixed, using laser Rayleigh scattering are reported. Through judicious design of experiments, laser Rayleigh scattering can be used to measure temperature (or concentration) at a data rate, and hence frequency response, DC-15 kHz, that is undemonstrated by any other present day laser based technique. Two demonstrations of laser Rayleigh thermometry are described: a turbulent premixed flame, and a turbulent jet diffusion flame. The turbulent jet diffusion flame uses a novel mixture of hydrogen and methane as fuel. This fuel mixture permitted the first laser Rayleigh thermometry in turbulent non-premixed flames. In these demonstrations, the Rayleigh scattered light intensity from a CW laser is used to produce a time series of temperature. From that time series, the temperature probability distribution function is generated as well as the power spectrum and autocorrelation. From the probability distribution function, the mean, variance and higher moments are easily generated.

14518 Numerical analysis of flowfields generated by accelerating flames. Kurylo, J. (Lawrence Berkeley Lab., CA); Dwyer, H.A.; Oppenheim, A.K. Contract W-7405-ENG-48. *AIAA (American Institute of Aeronautics and Astronautics) Journal ;* **18**: No. 3, 302-308(Mar 1980).

From AIAA Aerospace Sciences meeting; New Orleans, LA, USA (15 Jan 1979).

A numerical technique is presented for the analysis of nonsteady flowfields generated by accelerating flames in gaseous media. The problem is formulated in Eulerian coordinates and the solution is based on the extension of the floating shock-fitting technique to all the discontinuities and their interactions occurring in the flowfield. Besides shock waves, the discontinuities taken into account thus far consist of contact surfaces, deflagration, and detonation fronts. The governing partial differential equations are integrated by the use of an explicit second-order accurate, finite-difference scheme, while special algorithms are introduced for the treatment of segments of the flowfield where the influence zones of discontinuities overlap. Actual interactions between them are treated by the polar intersection method. The technique is applied to the case of a steady flame experiencing an abrupt increase in burning speed, leading either to the establishment of a new steady flame flow system or to further acceleration culminated by the transition to detonation. A demarcation line between the two regimes of solutions, depending on the value of the initial burning speed and the magnitude of its abrupt increase, is established, and the physical validity of this criterion is corroborated by experimental evidence.

42 ENGINEERING

4202 Facilities And Equipment

14519 (ORNL-tr—4727) Criticality experiments performed with a homogeneous plutonium solution results of experiments with annular and cylindrical geometries the effect of ^{240}Pu. A study on nuclei and reflective rings application of the technique of a pulsed neutron source on 2/18/65 or 12/17/65. Bouly, J.C.; Delgat, E.; Houelle, M. (Oak Ridge National Lab., TN (USA)). [nd]. Translation of CEA [Atomic Energy Board] DUSI [expansion unknown] Number 32, January 1966. 48p. NTIS, PC A03/MF A01.

The results of criticality experiments conducted with annular receptacles measuring 500 mm x 200 mm, 500 mm x 300 mm, 500 mm x 350 mm and a cylindrical receptacle 300 mm in dia are consolidated. The different contents of ^{240}Pu in the active solutions which were used [in the experiments] made it possible to evaluate the effect of this isotope on the critical masses of the 500 mm x 200 mm annular cylinder. Variations have also been determined for the critical masses of the 500 mm x 300 mm annular cylinder reflected externally by water as a function of the dimensions of the reflective cylinders or rings placed into the central cavity. Finally the pulsed neutron source technique was applied to the 500 mm x 300 mm annular cylinder, and the decay constant of the prompt neutrons was thus obtained for various levels of the active solution and various concentrations of the fissile element.

14520 (AD-A—087512) Properties of superconductor-normal metal-superconductor microbridges. Warlaumont, J.M. (Cornell Univ., Ithaca, NY (USA). School of Applied and Engineering Physics). 21 Jul 1980. 178p. NTIS, PC A09/MF A01.

Thesis.

This theses describes the fabrication and electrical measurement of short, high resistance (R approx. 1 ohm) superconductor-normal metal-superconductor microbridges. These small (length and width as small as 200 nm), planar structures were produced using electron-beam lithography and ion-beam etching. Lead-copper-lead structures were primarily studied; other materials were also briefly investigated. The small cross section of the bridges resulted in a uniform current distribution in the bridges at all temperatures, thus enabling the experimental determination of the critical current versus temperature relation for all temperatures between T sub c and 0.05 T sub c, where T sub C is the transition temperature of the electrodes. The low-voltage current-voltage (I-V) characteristics were studied in detail. Constant-voltage steps were observed in the I-V curves for all frequencies of microwave radiation used. The high resistance of these samples permitted measurement of the I-V curves for voltages much greater than the energy gap of the electrodes. A high-voltage peak in the dV/dI curves was observed, and it was speculated that this peak was due to an extra dissipation in the electrodes. In addition, the low-voltage resistance was found to have a temperature dependence which agreed with the phenomenological theory of Pippard et al., a theory which attributes the extra resistance to energy dissipation in the electrodes.

14521 (AD-A—087671) Josephson A/D converter development. Annual technical report 1 May 78-30 Apr 79. Hamilton, C.A.; Harris, R.E.; Kautz, R.L.; Lloyd, F.L.; Peterson, R.L. (National Bureau of Standards, Washington, DC (USA)). 1 Sep 1979. 66p. (SR—724-15-80). NTIS, PC A04/MF A01.

This report describes the second year of an effort to demonstrate an ultra-high-speed analog-to-digital converter using superconducting electronics. A converter was fabricated and tested, producing 200 to 700 megasamples per second. Experimental and theoretical support work is also presented.

14522 **(BDX—613-2572) Training manual for precision hand deburring, Part 3.** Gillespie, L.K. (Bendix Corp., Kansas City, MO (USA)). Mar 1981. Contract AC04-76DP00613. 203p. NTIS, PC A10/MF A01.

This publication is Part 3 of a 4 part training manual to be used by machinist trainees, production workers, and others removing burrs from precision miniature parts. The manuals are written to be self-teaching and are intended to be used with two hours of training each day along with six additional hours of bench work in deburring. This part describes mounted stones, scrapers, hand stones, abrasive filled rubber and cotton tools, abrasive paper products, felt bobs and lapping compounds, mandrels and arbors, miscellaneous tools, personal techniques for assuring quality, cleaning parts, and deburring gears and plastic parts.

14523 **(NUREG/CR—0930(Vol.1)) Puncture of shielded radioactive material shipping containers: analysis and results. Final technical report.** Larder, R.A.; Arthur, D.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1980. 49p. NTIS, PC A03/MF A01.

The development of improved analytical methods for predicting puncture of radioactive material shipping containers is reported. 59 static and dynamic puncture tests of lead-backed, uranium-backed, and unbacked flat, circular, stainless steel plates with several mild-steel punch configurations were conducted. It was found that analytical puncture prediction requires two essential elements: (1) a code that will accurately track stress and displacement throughout the event and (2) a criterion for identifying when and if puncture occurs. (The puncture event is not self-evident from the calculation.) The NIKE2D finite element code was coupled with the puncture criteria--a shear stress criterion for the lead-backed plates and a maximum effective plastic strain criterion for the uranium-backed plates; the results agreed very well with the test data.

14524 **(NUREG/CR—0930-Vol.2) Puncture of shielded radioactive material shipping containers: static and dynamic tests of laminated plates.** Larder, R.A.; Arthur, D.F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Apr 1980. 52p. NTIS PC E03/MF A01.

The report describes the development of improved analytical methods for predicting puncture of radioactive material shipping containers. 59 static and dynamic puncture tests of lead-backed, uranium-backed, and unbacked flat, circular, stainless steel plates with several mild-steel punch configurations were conducted. It was found that analytical puncture prediction requires two essential elements: (1) a code that will accurately track stress and displacement throughout the event and (2) a criterion for identifying when and if puncture occurs. (The puncture event is not self-evident from the calculation.) The NIKE2D finite element code was coupled with the puncture criteria--a shear stress criterion for the lead-backed plates and a maximum effective plastic strain criterion for the uranium-backed plates; the results agreed very well with the test data.

14525 **(PB—80-191380) Refrigeration for small superconductive devices. Final report.** Zimmermann, J.E.; Radebaugh, R.; Siegwarth, J.D. (National Bureau of Standards, Washington, DC (USA)). 1976. 8p. Pub. in Proc. Intl. Inst. of Refrigeration Commission A 1-2 und Deutscher Kaelte- und Klimatechnischer-Verein Commission I Joint Meeting, Munich (Germany, F.R.), Oct. 76. Paper in Developments in Cryogenic Techniques in the 1-20K Range, p53-60. International Inst. of Refrigeration, Paris (France) 1976.

The present state of the art is such that the greatest cost in using small superconducting devices, in many applications, is the expense and inconvenience of the associated cryogenic system. The practicality of such devices would be greatly enhanced, therefore, if a practical and economical self-contained, closed-cycle cryocooler could be made compatible with such devices. An experimental cryocooler has been built; its unique features (non-magnetic materials and very low input power) may represent a partial solution to the problem.

14526 **(PB—80-809148) Magnetic bearings. 1974-April, 1980 (citations from the NTIS Data Base). Report for 1974-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 22p. NTIS PC N01/MF N01.

The design and applications of magnetic bearings are treated in this brief retrospective survey from a relatively new field. Magnetic levitation is covered in another bibliography. Quantitative discussions of the dynamic behavior, including stiffness and cross-axis stabilities, are included. (Contains 14 citations)

14527 **(SAND—80-2681) Criticality safety analysis of the fissile material storage arrays in the east end of building 6592.** McKeon, D.C.; Philbin, J.S. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1981. Contract AC04-76DP00789. 12p. NTIS, PC A02/MF A01.

A criticality safety analysis of nine concrete storage holes that have been formed in the floor of the Materials Balance Area (MBA) in Building 6592 is reported. Unit cell dimensions and unit mass limits are defined for the most likely plutonium and uranium fuel types that will be stored there. Two tables of mass limits are derived. The first table is to be used for short units that can be stacked with fixed separation in the same hole. The second table will permit units greater than one foot in length providing that the appropriate linear mass density limit (in kg/ft) is not exceeded.

14528 **(SAND—81-0259C) Experiments with an explosively opened plasma switch.** Turman, B.N.; Tucker, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 13p. (CONF-810118—2). NTIS, PC A02/MF A01.

From Army research office workshop on repetitive opening switches; Durango, CA, USA (29 Jan 1981).

Scaling experiments have been performed on an explosively activated plasma opening switch. Current density and choice of explosive apparently are the most important variables in determining switch performance. Granular nitroguanadine, Octol, and Comp B3 explosives provide the fastest switching times. Granular nitroguanadine, when used to quench a planar plasma channel, gave a switch time of 0.3 μs at a current density of 60 kA/cm (90 kA current). Datasheet explosive was used to quench a cylindrical plasma channel, with submicrosecond switching time of megampere currents.

14529 **Handling radioactivity: a practical approach for scientists and engineers.** Stewart, D.C. New York, NY; John Wiley and Sons (1981). 300p.

The aim of this book is to present an overall view in a descriptive and essentially nonmathematical way of the practicalities of handling radioactivity. It is hoped that the material will be particularly helpful to those entering the nuclear field for the first time and to those working in related areas whose responsibilities require them to have a general knowledge of the subject of radioactivity handling and its vocabulary. The presentation is primarily for bench-scale operations. There is a considerable emphasis on facilities since these are fundamental to the safe handling of active materials. Facility design and detail is also unfortunately an area where the relevant information is largely scattered through literature sources that are not accessible to most readers. Some of the topics surveyed - such as dosimetry, shielding and nuclear criticality - are extremely complex and no pretense is made that the treatment here represents more than bare bone summaries of the fields. A considerable effort has been made to cite the key references in each area where more detailed information can be found. A few additional useful references not cited directly in the text appear in an abbreviated bibliography at the end of the book.

14530 **Nb-Al multifilamentary superconducting composites produced by powder processing.** Akihama, R.; Murphy, R.J.; Foner, S. (Francis Bitter National Magnet Laboratory and Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Applied Physics Letters ;* **37**: No. 12, 1107-1109(15 Dec 1980).

Multifilamentary superconducting Nb-Al composites were produced using powder processing with high overall critical cur-

rents J/sub c/ at high magnetic fields. A Nb—3 wt. % Al composite, reacted at 800 °C for 16 h, had J/sub c/ $>10^4$ A/cm² at 14 T at 4.2 K. J/sub c/ was almost independent of strain for strains up to 1.3%.

14531 **Remotely operated mechanical connector.** Bothwell, J.C.; Madden, D.S. (Aerojet Manufacturing Co., Fullerton, CA). *Transactions of the American Nuclear Society ;* **34**: 857-858(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14532 **Capabilities and application of existing hot cells at the Hanford Engineering Development Laboratory.** Pember, L.A.; Gruber, W.J.; McMahan, M.E.; Weber, E.T. (Hanford Eng Dev Lab, Richland, Wash). *Conference on Remote Systems Technology, Proceedings ;* 28-32(1979). (CONF-791103—P1).

From American Nuclear Society meeting; San Francisco, CA, USA (12 Nov 1979).

The hot cell facilities described provide a wide range of capabilities for postirradiation examination and testing of irradiated reactor fuels and structural materials to evaluate irradiation tests and determine failure mechanisms and effects of irradiation on physical and mechanical properties of reactor core components.

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REFER ALSO TO CITATION(S) 15114, 15161, 15162, 15165

14533 **(AD-A—087522) Injection laser mode studies. Final report 18 Apr 77-17 Apr 80.** Sommers, H.S. Jr. (RCA Labs., Princeton, NJ (USA)). Jun 1980. 30p. (PRRL—80-CR-23). NTIS, PC A03/MF A01.

This document is the sixth semiannual report and the final report of a basic study of the modes of injection lasers. The concern is the fundamental relationship between the modal properties of diode lasers, their structure, and the nature of the electrical drive. The semiannual report features three pioneering studies: The development of an equation of state relating the laser power, spectrum, and beam profile to the input current and laser structure; the behavior of the laser on transition of threshold as the current is increased through the immediate vicinity of threshold; and the comparison of the laser spectrum under pulsed drive to excitation with a dc current. It also touches on the behavior of quarternary lasers operating at 1.2 micrometers. The report concludes with a consideration of the outstanding fundamental problem at the present time, the dynamic interaction of the laser which reduces the number of spectral lines in the coherent output of a laser as the current drive is increased.

14534 **(AD-A—087682) Investigation of discharge processes in electrically excited blue/green lasers. Final report 1 Jun 79-31 May 80.** Wiegand, W.J. (United Technologies Research Center, East Hartford, CT (USA)). 31 Jul 1980. 48p. NTIS, PC A03/MF A01.

Total and partial cross sections for mercuric bromide ($HgBr^2$) electron attachment and ionization reactions of importance in laser discharges have been measured in electron beam experiments. Corresponding rate coefficients have been determined independently in a pulsed, electron swarm apparatus. These studies have determined that the electron impact ionization cross section of $HgBr^2$ is very large, increasing from a threshold at 10.6 eV to a value of 2 x 10 to the minus 15th power sq cm at 70 eV, with $HgBr^2$ ion being the principal ion formed at low energies. Beam measurements also have revealed only one electron loss process, dissociative attachment. This attachment reaction which produces Br ion has a threshold energy of 3.1 eV and a peak cross section of 1 x 10 to the minus 17th power sq cm at 3.7 eV. From swarm measurements, an attachment rate coefficient of 1.5 x 10 to the minus 10th power cu cm/sec at a few electron volts average electron energy has been determined. This value is consistent with cross section values determined from beam measurements and with values inferred from kinetic modeling studies of electron beam controlled HgBr2 laser discharges.

14535 **(AD-A—087714) Research studies on radiative collision lasers. Final technical report 10 Mar 77-9 Jan 80.** Harris, S.E.; Young, J.F. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Jun 1980. 38p. (GL—3090). NTIS, PC A03/MF A01.

This final report reviews the results of a program of theoretical and experimental studies of the physics and applications of radiative collisional processes involving two atoms and a photon simultaneously.

14536 **(AD-A—088739) Interaction of electrons and electromagnetic waves in periodic structures. Final progress report 1 oct 78-30 sep 79.** Grover, A. (Tel Aviv Univ. (Israel). School of Engineering). Feb 1979. 76p. NTIS, PC A05/MF A01.

We have further developed theoretical work on free electron lasers (FEL), proposed new mechanisms for FELs, developed numerical computational tools for electron gun design, continued optical experiments, completed the design and initial fabrication of two versions of electron guns, and made appreciable progress in the construction of an experimental set-up for spontaneous and stimulated Cerenkov-Smith-Purcell experiments.

14537 **(AD-A—090400) Analysis of multipass laser amplifier systems for storage laser media.** Harvey, J.F. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). Jun 1980. 21p. NTIS, PC A02/MF A01.

Highly efficient short pulse high power lasers have many potential applications, including laser fusion drivers. One technique for achieving high powers in short pulses is to use a storage laser amplifier. A storage laser amplifier uses a laser medium with a long lived upper laser level. The upper laser level can accumulate energy from a pumping source over a relatively long time. This stored energy is then extracted by stimulated emission over a relatively short time. Examples of such storage laser media are Nd:YAG, Nd:Glass, V:MgF_2, Tm:Glass, CO_2, and Group VI media (e.g., sulfur and selenium). The single pass amplifier system depicted in (top) is the simplest approach to amplifying a laser light pulse. The laser beam is passed once through the laser medium. The beam is amplified as it extracts energy stored in the medium's upper laser level. The single pass amplifier performance is limited in that it cannot simultaneously provide high energy gain and high efficiency. Under certain conditions these limitations can be overcome by using a multipass system such as the one depicted in the lower part. In this paper a single pass amplifier is investigated first using the Frantz-Nodvik theory of short pulse laser amplification. The multipass system is then treated by sequentially applying the single pass extraction equations for each extraction pass. In order to find the gain coefficient for each extraction, the changes occurring in the laser medium and in the laser beam fluence between extraction passes are determined using a simple three level laser kinetics model.

14538 **(AD-A—090559) A unified theory of magnetic bremsstrahlung, electrostatic bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers. Interim report 1979-1980.** Gover, A.; Sprangle, P. (Tel Aviv Univ. (Israel). Quantum Electronics Lab.). May 1980. 80p. NTIS, PC A05/MF A01.

This article discusses in a comparative way the main operating parameters of various free electron lasers, providing a useful tool for laser design, and for comparative evaluation of the various lasers. We show that the various kinds of FELs satisfy the same gain-dispersion relation and differ only in a single coupling parameter k. The different gain regimes which are common to all FELs are delineated. We find the small signal gain in all the gain regimes (warm and cold beam, low or high gain, single electron, collective or strong coupling interaction). The laser gain parameter, radiation extraction efficiency, maximum power generation and spectral width are given and compared in the various kinds of FELs and gain regimes. The maximum power generation of all FELs (except Compton-Raman scattering) is shown to be limited by an interaction region width parameter. This parameter and consequently the laser power is larger in the highly relativistic limit by a factor in all bremsstrahlung FELs in comparison to Cernkov-Smith-Purcell FELs. Some expressions which were derived earlier for the mag-

netic bremsstrahlung FEL, like the expression for gain in the low gain regime with space charge effect correction and the low gain expression for efficiency are shown to be special cases of more general expressions.

14539 **(AD-A—0897694) Theory of free electron laser instability in a relativistic annular electron beam. Technical report.** Uhm, H.S.; Davidson, R.C. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Aug 1980. 50p. NTIS, PC A03/MF A01.

A self-consistent theory of the free electron laser instability is developed for a hollow electron beam propagating through an undulator (multiple mirror) magnetic field. The stability analysis is carried out within the framework of the linearized Vlasov-Maxwell equations. The dispersion relation describing the free electron laser instability in a hollow relativistic electron beam is obtained for an equilibrium distribution function in which all electrons have same value of transverse energy and the same value of canonical angular momentum, and a Lorentian distribution in axial momentum. It is shown that the influence of finite radial geometry plays a critical role in determining detailed stability behavior. Moreover, the growth rate and bandwidth of the instability can be expressed in terms of Budker's parameter upsilon, instead of the plasma frequency as in the case of a uniform density beam. Furthermore, it is found that free electron laser stability properties exhibit a sensitive dependence on axial momentum spread.

14540 **(AD-A—0897868) Helically distorted relativistic electron beam equilibria for free electron laser applications. Technical report.** Davidson, R.C.; Uhm, H.S. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Jul 1980. 40p. NTIS, PC A03/MF A01.

The purpose of this paper is to develop a self-consistent kinetic description of helically distorted relativistic electron beam equilibria for free electron laser applications. In particular, radially confined equilibria are considered for a helically distorted electron beam propagating in the combined transverse wiggler and uniform axial guide fields.

14541 **(AD-A—0898338) Self-consistent Vlasov description of the free electron laser instability. Technical report.** Davidson, R.C.; Uhm, H.S. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Jan 1980. 41p. NTIS, PC A03/MF A01.

In recent years there have been several theoretical and experimental investigations of the free electron laser which generates coherent electromagnetic radiation using an intense relativistic electron beam as an energy source. With few exceptions, theoretical studies of the free electron laser instability are based on highly simplified models which often neglect beam kinetic effects and coupling to higher harmonics of the fundamental wiggler wavenumber k_0, or make use of very idealized approximations in analyzing the matrix dispersion relation. The purpose of the present paper is to develop a fully self-consistent description of the free electron laser instability based on the Vlasov-Maxwell equations. The final matrix dispersion relation includes all beam kinetic effects and coupling to arbitrary harmonic number (n) of the fundamental wiggler wavenumber k_0. Moreover, the final matrix dispersion relation makes no a priori assumption that any off-diagonal elements are negligibly small. The present analysis assumes a relativistic electron beam with uniform cross-section propagating in the z-direction through a helical wiggler field.

14542 **(AD-A—0899443) Generation and detection of submillimetre (FIR) radiation using optical pumping in a gas laser system. Final scientific report, 1 June 1976-30 September 1979.** Sexton, M.C. (University Coll., Cork (Ireland). Dept. of Electrical Engineering). 30 Nov 1979. 11p. NTIS, PC A02/MF A01.

The development of a CO_2 waveguide laser as a pump source for a CW far-infrared D_2O laser is described. Performance with regard to output power and tunability is reported with special reference to the application of these lasers in over-coming the mismatch which can exist between the pump laser frequency and the vibrational absorption of the pumped molecule. This report presents summaries of the construction and performance of such lasers as well as photoconductive detectors and points the direction towards the achievement of a tunable source of pump radiation for a D_2O laser. Absorption measurements in D_2O using the waveguide lser are also presented. Lasing action is straight H_2O and D_2O lasers is also summarised over the 20 to 120 micron wavelength range.

14543 **(AD-A—0901900) Bibliography of Soviet Laser Developments, Number 44, November-December 1979.** (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 13 Aug 1980. 155p. NTIS, PC A08/MF A01.

This is the Soviet Laser Bibliography for November-December 1979, and is No. 44 in a continuing series on Soviet laser developments. The coverage includes basic research on solid state, liquid gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

14544 **(DOE/DP/40069—3) KrF laser fusion: perform optical systems study of direct short pulse extraction. Final technical report, 26 June 1978-14 March 1981.** Bradford, R.S. Jr.; Betts, J.A.; Aprahamian, R.; Livingston, P.M. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). Mar 1981. Contract AC08-78DP40069. 116p. NTIS, PC A06/MF A01.

KrF is a prime candidate for a laser inertial confinement fusion (ICF) driver, however, there are still scaling issues to be addressed. The purpose of this program is to determine KrF performance in a regime of ICF interest both experimentally and analytically. Using a master oscillator-power amplifier (MOPA) configuration, 100J has been obtained from a five liter optical volume KrF amplifier pumped at 300 KW/cm^3 peak at the end of a 500 nsec pulse. A normalized input flux of 0.4 was required to reduce amplified spontaneous emission (ASE) to one half the free running value. A peak extraction efficiency of 0.46 was obtained under these conditions at 1 atm total pressure. The TRW kinetics model has been refined to give excellent agreement with high and low pump regimes. An integrated kinetics and pulse propagation code has also been developed and agrees well with experiment.

14545 **(DOE/DP/40069—4) Long-pulse KrF amplifier as an ICF driver.** Bradford, R.S. Jr.; Betts, J.A.; Aprahamian, R. (TRW Defense and Space Systems Group, Redondo Beach, CA (USA)). 1981. Contract AC08-78DP40069. 8p. (CONF-810204—3). NTIS, PC A02/MF A01.

From SPIE symposium on high-power lasers and applications; North Hollywood, CA, USA (11 Feb 1981).

Using a master oscillator-power amplifier (MOPA) configuration, 100J has been obtained from a 5 l optical volume KrF amplifier pumped at 300 kW/cm^3 peak at the end of a 500 nsec pulse. A normalized input flux of 0.4 (I/I/sub sat/) was required to reduce amplified spontaneous emission (ASE) to one half the free running value. A peak extraction efficiency of 0.46 was obtained under these conditions at 1 atm total pressure. A kinetics model has been developed and refined to give excellent agreement with high and low pump regimes. An integrated kinetics and pulse propagation code has also been developed and agrees well with experiment.

14546 **(PB—80-808835) Color centers and color center lasers. 1970-April 1980 (citations from the NTIS Data Base). Report for 1970-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 196p. NTIS PC N01/MF N01.

The creation processes and analyses of a variety of color centers in many types of solid state materials, and some useful applications for these defect centers, are described in the cited works. The centers are created by various forms of particle and electromagnetic radiation, including light, by heat, by stress, by crystal growth processes, and others. They are analysed by electron spin resonance (ESR), optical absorption, electron-nuclear double resonance (ENDOR), measurements of stored energy, kinetics of for-

mation and decay, thermoluminescence, etc. Some applications cited are as laser systems, laser Q-switches, dosimeters, high-density, 3-D optical information storage (including holographic and photographic) devices, optical memories, and optical computer elements. (Contains 195 citations)

14547 **(PB—80-808843) Color centers and color center lasers. 1970-April 1980 (citations from the Engineering Index Data Base). Report for 1970-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 184p. NTIS PC N01/MF N01.

The creation processes and analyses of a variety of color centers in many types of solid state materials, and some useful applications for these defect centers, are described in the cited works. The centers are created by various forms of particle and electromagnetic radiation, including light, by heat, by stress, by crystal growth processes, and others. They are analysed by electron spin resonance (ESR), optical absorption, electron-nuclear double resonance (ENDOR), measurements of stored energy, kinetics of formation and decay, thermoluminescence, etc. Some applications cited are as laser systems, holographic storage media, and photographic materials. (Contains 200 citations)

14548 **(PB—80-808850) Color centers and color center lasers. 1964-April 1980 (citations from the International Aerospace Abstracts Data Base). Report for 1964-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 76p. NTIS PC N01/MF N01.

The creation processes and analyses of a variety of color centers in many types of solid state materials, and some useful applications for these defect centers, are described in the cited works. The centers are created by various forms of particle and electromagnetic radiation, including light, by stress, by crystal growth processes, and others. They are analysed by electron spin resonance (ESR), optical absorption, electron-nuclear double resonance (ENDOR), measurements of stored energy, kinetics of formation and decay, thermoluminescence, etc. Some applications cited are as laser systems, optical computer elements, holographic and other optical image storage devices, and as high-density optical memories. (Contains 79 citations)

14549 **(PB—80-808892) Double heterostructure used in diode lasers and light emitting diodes. 1972-April 1980 (citations from the International Aerospace Abstracts Data Base). Report for 1972-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 114p. NTIS PC N01/MF N01.

The use of a double heterostructure, or double heterojunction, in the construction of semiconductor lasers and light emitting diodes (LEDs), is detailed in the cited abstracts. Crystal growth and doping, fabrication methods, overall laser or LED design and construction, and performance data are presented for a variety of double heterostructure devices. Numerous applications are described. (Contains 121 citations)

14550 **(PB—80-808900) Double heterostructure used in diode lasers and light emitting diodes. 1972-April 1980 (citations from the Engineering Index Data Base). Report for 1972-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 132p. NTIS PC N01/MF N01.

The use of a double heterostructure or double heterojunction in the construction of semiconductor lasers and light emitting diodes (LEDs), is detailed in the cited abstracts. Crystal growth and doping, fabrication methods, overall laser or LED design and construction, and performance data are presented for a variety of double heterostructure devices. Numerous applications are described. (Contains 138 citations)

14551 **(PB—80-810419) Radiation damage of laser materials. 1964-April, 1980 (citations from the NTIS data base). Report for 1964-Apr 80.** Carrigan, B. (National Technical Information Service, Springfield, VA (USA)). May 1980. 224p. NTIS PC N01/MF N01.

Laser beam damage to laser materials such as optical glass, glass fibers, alkali metal halides, metals, mirrors, optical coatings, dielectrics, semiconductors, and matrix materials is studied. The majority of these citations concern infrared laser damage to infrared optical materials. (This updated bibliography contains 217 abstracts, 10 of which are new entries to the previous edition.)

14552 **(PB—80-812928) Gas dynamic lasers. 1964-June, 1980 (citations from the NTIS data base). Report for 1964-June 1980.** Carrigan, B. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 264p. NTIS PC N01/MF N01.

The citations cover research on kinetic and energy transfer processes, design, optics, nozzles, and performance of gas and chemical lasers relying on gas dynamic effects for lasing enhancement. Diffusion and flow studies specifically applicable to such lasers are also included. (This updated bibliography contains 253 citations, 6 of which are new entries to the previous edition.)

14553 **(PB—80-813223) Neodymium YAG lasers. 1964-June 1980 (citations from the NTIS Data Base). Report for 1964-June 1980.** Carrigan, B. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 186p. NTIS PC N01/MF N01.

Federally-funded research reports on lasing of neodymium doped yttrium aluminum garnet are cited. Studies on design, fabrication, quantum efficiency, light pulses, stabilization, and testing are covered. Optical pumping, mode locking, frequency conversion, and modulation of these lasers are discussed. Laser applications such as optical communications, range finding, and tracking are included. Safety hazards and radiation damage related to neodymium YAG lasers are also covered. (This updated bibliography contains 181 citations, 15 of which are new entries to the previous edition.)

14554 **(PB—80-813520) Gallium arsenide lasers. 1976-July 1980 (citations from the International Aerospace Abstracts Data Base). Report for 1976-July 1980.** Mauk, S.C. (New Mexico Univ., Albuquerque (USA). Technology Application Center). Aug 1980. 79p. NTIS PC N01/MF N01.

This bibliography cites articles from the international literature concerning the research, testing, and applications of gallium arsenide and aluminum gallium arsenide double heterojunction lasers. (This updated bibliography contains 340 citations, 114 of which are new entries to the previous edition.)

14555 **(PB—80-813538) Dye lasers. 1976-July 1980 (citations from the International Aerospace Abstracts Data Base). Report for 1976-July 1980.** Mauk, S.C. (New Mexico Univ., Albuquerque (USA). Technology Application Center). Aug 1980. 94p. NTIS PC N01/MF N01.

This bibliography cites articles from the international literature involving continuous wave, pulsed, ultrashort pulsed, ultraviolet, and infrared lasers. Articles covering laser outputs, materials, and applications are stressed. (This updated bibliography contains 473 citations, 194 of which are new entries to the previous edition.)

14556 **(UCID—18943) Perturbation theory for the variable parameter free electron laser.** Garrison, J.C.; Wong, J. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 27 Feb 1981. Contract W-7405-ENG-48. 110p. NTIS, PC A06/MF A01.

The potential utility of free electron lasers (FEL) for the production of high power tunable radiation has stimulated a large number of theoretical studies. These may be roughly divided into two groups. The first group consists of computer simulations in which the equations of motion for a large number of electrons are numerically integrated in conjunction with Maxwell's equations for the propagating signal field. The procedure in the second group is essentially analytical. Approximate analytical solutions of the Liouville equation for the electron distribution function are constructed and then used to evaluate the electric current appearing in Maxwell's equations. This gives closed equations for the radiation field which must still be solved numerically. The results of a qualitative study of some of the properties of the one-dimensional FEL model are presented using the analytical rather than the computational route.

14557 **Kinetic processes in Ar-Kr-F_2 laser mixtures.** Morgan, W.L.; Szoeke, A. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1256-1265(Mar 1981).

Time-dependent fluorescence measurements were made on Ar-F_2, Kr-F_2, and Ar-Kr-F_2 mixtures excited by a short-pulse, low-current electron beam excitation in pressure ranges appropriate for rare-gas—halide lasers. A kinetic model was assembled that correctly analyzes integrated intensities and time dependences of the various emission bands of ArF^*, Ar_2F^*, KrF^*, and Kr_2F^*. We present the structure of the model and several revised rate coefficients obtained from it. The model also fits other published experimental data and agrees well with KrF laser pulse shapes and efficiencies. Cross sections for electron-impact dissociative excitation of F_2, which were obtained from analysis of published data, are also presented.

14558 **Theory of nonlinear absorption in InSb spin-flip laser.** Nee, T.; Scully, M.O. (Department of Physics and Institute of Physics and Astronomy, National Central University, Chung-li, Taiwan 320, Republic of China). *Journal of Applied Physics ;* **52**: No. 1, 102-108(Jan 1981).

The strong transient optical absorption in n-InSb Raman spin-flip laser device at 2 °K was interpreted due to the intense laser-generated hot conduction electrons. We present the microscopic theoretical calculation for this nonlinear and nonequilibrium optical effect. By assuming the time-dependent functions for electronic temperature and Fermi energy, the time evolution of the nonequilibrium hot electron distribution during the pulsed laser irradiation is calculated.

14559 **Laser dye DCM, its spectral properties, synthesis and comparison with other dyes in the red.** Hammond, P.R. (Lawrence Livermore Lab., CA). Contract W-7405-ENG-48. *Optics Communications ;* **29**: No. 3, 331-333(Jun 1979).

4-Dicyanomethylene-2-methyl-6-p-dimethylaminostyryl-4H-pyran (DCM) in dimethyl sulfoxide has a broad tuning range and is the most efficient dye yet reported for the 630 to 680 nm region.

14560 **Spectroscopy of the CF_4 laser.** McDowell, R.S.; Patterson, C.W.; Jones, C.R.; Buchwald, M.I.; Telle, J.M. (Los Alamos Scientific Lab., NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 262-269(1979).

From LASL conference on optics '79; Los Alamos, NM, USA (23 May 1979).

When $\nu_2 + \nu_4$ of CF_4 at 1066 cm^{-1} is pumped by the 9.4-μm CO_2 laser, stimulated emission on the $(\nu_2 + \nu_4) \rightarrow \nu_2$ transition produces many discrete laser lines in the region 605 to 655 cm^{-1}. A comprehensive program of Doppler-limited absorption spectroscopy of CF_4 has been carried out using tunable semiconductor diode lasers, and has led to a full understanding of the rovibrational energy levels involved in the laser process. The frequencies of 28 laser lines of $^{13}CF_4$ have been measured with an accuracy of +-0.2 cm^{-1}, for $^{13}C^{16}O_2$ pump lines from P(14) to R(24). From the complete vibration-rotation analysis of the $\nu_2 + \nu_4$ band, the pump and laser transitions have been identified. Using the spectroscopic constants determined in the band analyses, we can predict within +-0.2 cm^{-1} the laser lines to be expected from any given pumping frequency. All observed laser lines have been accounted for; in a few cases there is evidence for a relaxation of J-value and/or Coriolis sublevel in the upper state. Application of these results to improving the performance of the CF_4 laser and for designing it to produce specific desired output frequencies is discussed.

14561 **Silicon vidicon system for measuring laser intensity profiles.** Smith, W.L.; Degroot, A.J.; Weber, M.J. (California, University, Livermore, Calif.). W-7405-ENG-48. *Applied Optics ;* **17**: 3938-3944(15 Dec 1978).

A silicon-target vidicon and minicomputer system providing rapid recording, readout, and processing of laser beam intensity profiles is described. Results are presented for 150-psec, 1064-nm neodymium laser pulses. Use of a thick, neutron-transmutation-doped silicon target reduced spatial sensitivity nonuniformities and coherent interference modulation. Modifications of commercial cameras to provide linearized output and timing control are described. The vidicon signal is recorded in a video disk recorder, digitized, and stored on a magnetic disk. Selected one-dimensional profiles and color isointensity whole beam profiles are available on CRT displays. Using a PDP-11 computer, the beam is analyzed to yield a peak energy flux within 100 sec after the laser pulse. The performance of the vidicon system is compared with photographic film techniques. Results show a sensitivity uniformity of greater than or equal to 93% peak to peak over a target distance of 9.6 mm, linear dynamic range of greater than or about 20, and absolute flux agreement within plus or minus 10%. The system is useful for other laser wavelengths and pulse durations as well as for nonlaser applications.

14562 **An efficient, high-power F_2 laser near 157 nm.** Woodworth, J.R.; Rice, J.K. (Sandia Laboratories, Albuquerque, N. Mex.). *Journal of Chemical Physics, The ;* **69**: 2500-2504(15 Sep 1978).

Experimental results are presented which demonstrate scaling of an electron-beam-excited molecular F_2 laser operating near 157.5 nm in mixtures of high-pressure He and a few torr of F_2 to high powers (7 MW/sq cm unfocused) and high intrinsic efficiencies (3.5%). Results of a parametric study of laser and fluorescence efficiency vs. He and F_2 pressures are also given, along with measurements of sidelight saturation which indicate 30% saturation of the excited medium by the F_2 laser photons. A model is described which quantitatively accounts for the observed fluorescence efficiency.

4204 Heat Transfer And Fluid Flow

14563 **(PB—80-810567) Cavitation: cavitation flow. 1974-April, 1980 (citations from the NTIS data base). Report for 1974-April 1980.** Habercom, G.E. Jr. (National Technical Information Service, Springfield, VA (USA)). May 1980. 259p. NTIS PC N01/MF N01.

The bibliography includes reports on general aspects of cavitating flow. A wide range of theoretical, analytical, and experimental information is presented involving mathematical analysis, computer programs, and testing. Topics include marine engineering, hydrodynamic and aerodynamic configurations, symmetric and non-axisymmetric shapes, and measuring technology. Data is given on surface piercing struts, helical inducers, pumps, liquid metal systems, and venturi tubes. Applications include dam outlets and spillways, vertical conduits, deep rock drilling, heat pipe stability, water entry, and liquid cryogenic systems. Discussions are made of flow characteristics, noise, nucleate boiling, perturbation problems, and allied subjects. Cavitation related to turbines, propellers, rudders, cavities, and hydrofoils is not included. These topics, and materials on cavitation corrosion and erosion, are covered in other associated bibliographies. (This updated bibliography contains 253 abstracts, 17 of which are new entries to the previous edition.)

4205 Materials Testing

REFER ALSO TO CITATION(S) 14130

14564 **(EGG-FM—5314) Effects of surface-mapping corrections and synthetic-aperture focusing techniques on ultrasonic imaging.** Barna, B.A.; Johnson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1981. Contract AC07-76ID01570. 79p. NTIS, PC A05/MF A01.

Improvements in ultrasonic imaging that can be obtained using algorithms that map the surface of targets are evaluated. This information is incorporated in the application of synthetic-aperture focusing techniques which also have the potential to improve image resolution. Images obtained using directed-beam (flat) transducers and the focused transducers normally used for synthetic-aperture processing are quantitatively compared by using no processing, synthetic-aperture processing with no corrections for surface variations, and synthetic-aperture processing with surface mapping. The unprocessed images have relatively poor lateral resolutions because echoes from two adjacent reflectors show interference effects which prevent their identification even if the spacing is larger than the single-hole resolution. The synthetic-aperture-processed images

show at least a twofold improvement in lateral resolution and greatly reduced interference effects in multiple-hole images compared to directed-beam images. Perhaps more importantly, in images of test blocks with substantial surface variations portions of the image are displaced from their actual positions by several wavelengths. To correct for this effect an algorithm has been developed for calculating the surface variations. The corrected images produced using this algorithm are accurate within the experimental error. In addition, the same algorithm, when applied to the directed-beam data, produced images that are not only accurately positioned, but that also have a resolution comparable to conventional synthetic-aperture-processed images obtained from focused-transducer data. This suggests that using synthetic-aperture processing on the type of data normally collected during directed-beam ultrasonic inspections would eliminate the need to rescan for synthetic-aperture enhancement.

14565 **(UCID—18598(Rev.1)) Data Capture Unit (DCU) users guide.** Meyer, D.A.; Coradetti, T. (Lawrence Livermore National Lab., CA (USA)). 4 Feb 1981. Contract W-7405-ENG-48. 55p. NTIS, PC A04/MF A01.

The Data Capture Unit is a modular data acquisition system for acquiring data during mechanical shock and vibration environmental tests. The microprocessor-controlled hardware receives English-type commands over an IEEE 488-1978 instrument interface bus. The commands allow for the setup and control of the sampling process, including sample rate, triggering, data channel gain, and anti-aliasing filter cutoff and type. 15 figures.

4208 Electronic Circuits And Devices

14566 **(LA-UR—81-377) Development of integrated thermionic circuits for high-temperature applications.** McCormick, J.B.; Wilde, D.; Depp, S.; Hamilton, D.J.; Kerwin, W.; Derouin, C.; Roybal, L.; Dooley, R. (Los Alamos National Lab., NM (USA); IBM Research Div., San Jose, CA (USA); Arizona Univ., Tucson (USA)). 1981. Contract W-7405-ENG-36. 6p. (CONF-810316—4). NTIS, PC A02/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

A class of devices known as integrated thermionic circuits (ITC) capable of extended operation in ambient temperatures up to 500°C is described. The evolution of the ITC concept is discussed. A set of practical design and performance equations is demonstrated. Recent experimental results are discussed in which both devices and simple circuits have successfully operated in 500°C environments for extended periods of time.

14567 **(PB—80-182546) Modeling technological innovation in private firms: the solar and microprocessor industries in northern California.** Rogers, E.M.; Walling, V.C.; Leonard-Barton, D.; Gibson, D.W. (Stanford Univ., CA (USA). Inst. for Communication Research). Mar 1980. 230p. NTIS, PC A11/MF A01.

The purpose of the report is to present the results from a research project on modeling technological innovation in the solar flat-plate collector industry and the microprocessor industry in Northern California during 1979. The objectives of this research were: To generate a framework for the study of technological innovation in private organizations; to test and demonstrate the feasibility of using this framework to determine how innovation occurs in firms within two industries; and to provide a foundation for a long-range institutional program in technological innovation and public policy. Each of the two industries of study is organized around a basic innovation: (1) the solar industry rests on the solar flat-plate collector dates from the turn of the century and (2) the microprocessor industry rests on the idea of putting a computer on a small silicon chip.

14568 **Prebreakdown phenomena between sphere-sphere electrodes in transformer oil.** Kelley, E.F.; Hebner, R.E. Jr. (Electrosystems Division, National Bureau of Standards, Washington, D.C. 20234). *Applied Physics Letters ;* **38**: No. 4, 231-233(15 Feb 1981).

Measurements have been made of the propagation velocities of both cathode and anode streamers in transformer oil using sphere-sphere electrodes. Under the conditions of these experiments, the cathode streamer development was a three-step process, while the anode streamer development was a two-step process. The average propagation velocities for the three-steps of the cathode process were 2.4×10^4, 1.5×10^5, and 3.9×10^6 cm/s. The two steps of the anode process propagated at average velocities of 3.8×10^5 and 4.4×10^6 cm/s.

14569 **(DOE/TIC—11398) Logic board tester: general purpose.** (Bonneville Power Administration, Portland, OR (USA)). [nd]. 100p. NTIS, PC A05/MF A01.

A device for testing logic boards is described in detail. As a logic board tester, this machine was designed to provide 120 independently programmable I/O channels, each having a 1024-bit data storage capacity. Its speed has been demonstrated at a solid 4.5 MHz, and a glitch as narrow as 23 nsec on any channel should cause the machine to halt with an error indication in that channel. Narrower glitches will halt the machine without an error indication. As a secondary function, this tester should be able to operate as a basic data-domain logic analyzer, having the same performance features. Triggering on any combination of bits or channels is provided with up to 999 words of post-trigger recording within a memory frame of up to 1024 words, of up to 120 bits each. Another possible function of the tester would be programmable word generation. Programming is uncomplicated, and programs may be modified on the fly during the board testing, a necessary feature in troubleshooting. Such modifications include addition or deletion of entire I/O channels and bit string generation of any predetermined length of 1's, 0's, or random patterns, in addition to single bit changes. It is possible semiautomatically to load square waves of varying periods, ranging from a change at every memory location, to a change after each 64 memory locations, each period being twice as long as the preceding one. Whole word transfers between any memory locations are very easy, enabling duplication or shifting of entire blocks of a program. A work search feature enables automatic location of any arrangement of bits of any length (up to 120). Various other convenience and fail-safe features are included. (RWR)

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 13824

4210 Combustion Systems

REFER ALSO TO CITATION(S) 13362, 13559, 14517, 14584

14570 **(CONF-810309—9) Design of the atmospheric fluidized-bed coal combustor for cogeneration gas-turbine system.** Holcomb, R.S.; Berman, P.A.; Gorrell, R.L. (Oak Ridge National Lab., TN (USA); Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.; Babcock and Wilcox Co., Barberton, OH (USA)). 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01.

From ASME gas turbine conference; Houston, TX, USA (9 Mar 1981).

The AFB Coal Combustor for Cogeneration Program, sponsored by the US Department of Energy, has as its objective the development of the technology for a fluidized bed coal combustion system to provide a source of high-temperature air for power generation with gas turbines and for process heating in industrial plants. The program is directed toward systems in the size range of 5 to 50 MW(e) and is being conducted by the Oak Ridge National Laboratory and its subcontractors. The major effort in the program is the design of a generic reference plant cogeneration system and the design and construction of a test system that will incorporate the salient features of the reference plant. The design work was initiated in June 1980.

14571 **(PB—80-175599) Advanced combustion systems for stationary gas turbine engines. Volume I. Review and preliminary evaluation. Final report December 1975-September 1976.** Mosier, S.A.; Pierce, R.M. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). Jan 1980. 49p. NTIS, PC A03/MF A01.

An exploratory development program to identify, evaluate, and demonstrate dry techniques for significantly reducing NOx from thermal and fuel-bound sources in stationary gas turbine engines is described. Volume 1 covers Phase I of the four-phase effort. In Phase I, duty cycles were analyzed to identify current and projected dominant operating modes and requirements of stationary gas turbine engines. These analyses indicate that as compression ratios and turbine inlet temperatures are increased to improve thermal efficiency, uncontrolled NOx emissions can be expected to double in 10 y and triple in 20 y. An extensive survey was made of candidate combustor concepts, and an analytical study was made from which those concepts considered to have significant potential for reducing production of NOx were identified. An initial compilation of 26 combustor design concepts was assembled, indicating potential for controlling NOx from clean fuels and/or fuels containing significant amounts of bound nitrogen. Computer simulations of these combustor concepts aided in prioritizing the designs prior to experimental screening in a bench-scale combustor test rig. The experiments were carried out under Phase II and are described in Volume 2.

14572 **(PB—80-175607) Advanced combustion systems for stationary gas turbine engines. Volume II. Bench scale evaluation. Final report September 1976-January 1978.** Pierce, R.M.; Mosier, S.A.; Smith, C.E.; Hinton, B.S. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). Jan 1980. 355p. NTIS, PC A16/MF A01.

The reports describe an exploratory development program to identify, evaluate, and demonstrate dry techniques for significantly reducing NOx emissions from stationary gas turbine combustors. (Volume 1 documents the research activities leading to selection of 26 combustor design concepts which could potentially meet the program goals.) Volume 2 documents the Phase II bench-scale evaluation of those concepts to experimentally evaluate their emission reduction potential. Results from the testing program identified two design approaches capable of significant emission reduction. A staged centertube design, relying on burner operation near the lean blowout limit, gave low NOx and CO emissions on clean No. 2 fuel oil, but was ineffective for fuels containing bound nitrogen. A rich-burn/quick-quench (RB/QQ) design, producing a fuel-rich primary zone and quickly quenching the effluent from that region to the high overall excess air conditions required by the gas turbine cycle, successfully controls NOx from both thermal and fuel-bound sources while maintaining low CO emissions for high thermal efficiency. The RB/QQ concept was selected for scaleup to full size hardware in Phases III and IV.

14573 **(PB—80-204936) Technology assessment report for industrial boiler applications: oil cleaning. Final report, June 1978-September 1979.** Comley, E.A.; Keen, R.T.; Tyndall, M.F. (Catalytic, Inc., Charlotte, NC (USA)). Nov 1979. Contract EPA-68-02-2604. 274p. NTIS, PC A12/MF A01.

This study assesses the applicability of oil cleaning technology to industrial boilers and is one of a series of technology assessment reports to aid in determining the technological basis for a New Source Performance Standard for Industrial Boilers. The status of development and performance of alternative oil cleaning techniques were assessed and the cost, energy, and environmental impacts of the most promising processes were identified.

14574 **(PB—80-205453) Industrial burner and process efficiency program. Annual report for 1979.** Huebner, S.R.; Singh, S.N. (Midland-Ross Corp., Toledo, OH (USA). Technical Center - Thermal Systems). Mar 1980. Contract GRI-5011-342-0148. 37p. NTIS, PC A03/MF A01.

An analysis of the FM control burner in a cold model test has shown that FM control has the capability of increasing the turbulent convective velocity of the jet stream compared to conventional AM control. Thus, it results in a higher convective heat transfer coefficient and higher thermal efficiencies. Based on the concepts formulated, a high momentum burner has been designed. This burner has been successfully fired with natural gas and No. 2 fuel oil, using combustion air preheated to 1100F.

14575 **(PB—80-205479) Environmental control of gas appliances. Annual report for 1979.** Waters, A.M.; Himmel, R.L. (American Gas Association Labs., Cleveland, OH). Jan 1980. Contract GRI-5014-352-0163. 66p. NTIS, PC A04/MF A01.

The report discusses studies aimed at reducing the NOx emissions from gas-fired furnaces and water heaters by minor modifications of the combustion system, such as derate, primary air adjustment and excess air minimization. The influence of NOx emission reduction and seasonal efficiency improvement on the NOx emission factor in nanograms/joule heat output are discussed. Emission inventory for gas-fired clothes dryers and a pulse combustion type boiler are presented. Further studies of the effect of burner design on NOx emission is discussed as in the effect of changes in the fuel gas composition. Finally, a report on proper sampling of a gas-fired appliance is reviewed and the highlights presented in this report.

14576 **(PB—80-207046) Thirty-day field tests of industrial boilers: site 2 - residual-oil-fired boiler. Final report, March 1979-March 1980.** Carter, W.A.; Tidona, R.J. (KVB, Inc., Irvine, CA (USA)). Apr 1980. Contract EPA-68-02-2645. 195p. NTIS, PC A09/MF A01.

This report is a final one for a test program to evaluate the long-term effectiveness of combustion modifications on industrial boilers. Previous short-term tests had been performed on industrial boilers to determine the effect of combustion modifications on such air pollutant emissions as NOx, SOx, CO, HC, and particulate. The objective of this program was to determine if the combustion modification techniques which were effective for the short-term tests are feasible for longer periods. The report gives results of a 30-day field test of a 26.4 MW output (90,000 lb steam/hr) residual-oil-fired boiler using staged combustion air and low excess air to control NOx emissions. Results indicate that these combustion modifications are effective long-term NOx controls for this type of residual-oil-fired boiler. The as-found NOx concentration was 158 ng/J (281 ppm at 3% O2, dry). With staged combustion and low excess air firing, the mean NOx emission level was 110 ng/J (196 ppm at 3% O2, dry). Boiler efficiency increased by 0.7% under low NOx firing conditions.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 13376, 13381

14577 **Environmental exposure and design criteria for offshore oil and gas structures.** Washington, DC; National Academy of Sciences (1980). 230p. (NP—25262).

In order to develop offshore petroleum resources in a timely, safe, and economical fashion, government and industry need to understand the environmental factors that affect drilling on the outer continental shelf, particularly in the deep water and Arctic areas. It is recommended that the Geological Survey should develop the engineering capability to appraise environmental exposures and to acquire related area. This could be done by creating a new office within the Geological Survey, with the following responsibilities: perform quantitative appraisals of expected environmental exposure risks and of environmental design criteria for oil and gas operations; extend the technology and environmental data bases; develop the technical and engineering expertise needed for the appraisals; obtain the needed environmental data; identify situations where data needs of government and industry might coincide to avoid duplication; and provide a focal point for information exchange. (DLC)

4240 Pollution Control Equipment

14578 **(PB—80-173636) Technology assessment report for industrial boiler applications: NO/sub x/ flue gas treatment. Final report June 1978-November 1979.** Jones, G.D.; Johnson, K.L. (Radian Corp., Austin, TX (USA)). Dec 1979. 574p. NTIS, PC A24/MF A01.

The report gives results of an assessment of the applicability of NOx flue gas treatment (FGT) technology to industrial boilers and is one of a series of technology assessment reports to aid in determining the technological basis for a New Source Performance Standard for Industrial Boilers. The status of development and performance of alternative NOx FGT control techniques were assessed and the cost, energy, and environmental impacts of the most promising processes were identified. Cost estimates of applying SCR processes in the U.S. indicated that the cost effectiveness varies significantly depending on the fuel fired, boiler size, and control level. For regulatory purposes this assessment must be viewed as preliminary, pending results of the more extensive impact studies required by Clean Air Act Sect. III.

14579 **(PB—80-175037) Pilot-scale field tests of high-gradient magnetic filtration. Final report, September 1977-December 1979.** Gooding, C.H. (Research Triangle Inst., Research Triangle Park, NC (USA)). Mar 1980. 143p. NTIS, PC A07/MF A01.

The report gives results of using a 5100 cu m/hr mobile pilot plant to evaluate the effectiveness and economics of applying high-gradient magnetic filtration (HGMF) to particulate emission control. A 4-1/2 month test program was conducted at a Pennsylvania sintering plant to characterize the performance of the pilot plant and to demonstrate its practicality under long-term operation. Analysis of the results indicates that high-efficiency collection can be achieved economically if HGMF is applied to steel industry dusts that are more homogeneous and more strongly magnetic than the tested sinter dust. The report describes laboratory pilot-plant work that demonstrated collection efficiencies greater than 99% with basic oxygen furnace and electric arc furnace dusts. The development of a filter cleaning system and the design and construction of the pilot plant are discussed. Experimental data are reported.

14580 **(PB—80-177108) Advanced combustion systems for stationary gas turbine engines: Volume III. Combustor verification testing. Final report, January 1978-April 1979.** Pierce, R.M.; Smith, C.E.; Hinton, B.S. (Pratt and Whitney Aircraft Group, West Palm Beach, FL (USA). Government Products Div.). Jan 1980. 152p. NTIS, PC A08/MF A01.

The reports describe an exploratory development program to identify, evaluate, and demonstrate dry techniques for significantly reducing NOx from stationary gas turbine engines. Volume 3 describes the scaleup of the rich-burn/quick-quench (RB/QQ) model to a full-scale (25 MW) gas turbine combustor, and documents test results from the full-scale evaluations. Test results were very positive, showing that the RB/QQ concept can reduce NOx to approximately 45 ppm (at zero % O_2) for clean distillate oil and to approximately 75 ppm for a distillate oil doped to 0.5% nitrogen, as pyridine. CO emissions below the 100 ppm program goal were also demonstrated. These tests also indicate that the new combustor concept may be capable of low emission performance on petroleum residual oil and synthetic liquid fuels such as SRC II or shale oil. Results from testing on those fuels is included in Volume 4, an addendum.

14581 **(PB—80-177207) Source assessment: dry bottom industrial boilers firing pulverized bituminous coal. Final report, August 1974-June 1979.** McCurley, W.R.; Moscowitz, C.M.; Ochsner, J.C.; Reznik, R.B. (Monsanto Research Corp., Dayton, OH (USA)). Jun 1979. 199p. NTIS, PC A09/MF A01.

The report describes and assesses the potential impact of air emissions, wastewater effluents, and solid wastes from the operation of dry bottom industrial boilers firing pulverized bituminous coal. Air emissions were characterized by a literature survey and field sampling. Significant emissions resulting from coal combustion were particulate matter, sulfur oxides (SOx), nitrogen oxides (NOx), hydrocarbons, polycyclic organic materials (POM), and a number of elements. The potential environmental impact of each emission species after passing through state-of-the-art controls was individually assessed using a calculated quantity known as the source severity. Species determined to have source severities greater than 1.0 were NOx (1.7), SOx (2.2), and POM (6.0). Pollutant concentrations were also measured in wastewater and solid waste streams. Effluent source severities were found to be significantly less than 1.0 for most species. The potential impact of solid waste discharges on the quality of air and of ground and surface water was also found to be minor when available controls were applied.

14582 **(PB—80-177215) Technology assessment report for industrial boiler applications: NOx combustion modification. Final report, June 1978-June 1979.** Lim, K.J.; Milligan, R.J.; Lips, H.I.; Castaldini, C.; Merrill, R.S. (Acurex Corp., Mountain View, CA (USA)). Dec 1979. 500p. NTIS, PC A21/MF A01.

The report gives results of an assessment of current and developing combustion modification NOx control technology for coal-, oil-, and natural-gas-fired industrial boilers. Control effectiveness and applicability, reliability and availability, process impacts, capital and operating costs, energy impacts, and environmental impacts are evaluated. Currently available techniques are capable of moderate (10-25%) NOx reductions for coal- and residual-oil-fired boilers and major (40-70%) reductions for distillate-oil- and gas-fired units with minimal adverse operating impacts. Combustion modifications are estimated to increase the cost of steam by only 1-2%, but could increase the initial capital cost of a boiler by 1-20%. Analysis of measured or postulated incremental emissions, other than NOx, indicates that these emissions are generally unaffected when preferred NOx controls are implemented, although further testing is warranted.

14583 **(PB—80-177413) Pilot scale combustion evaluation of waste and alternate fuels: Phase III, final report. Report for February-August 1978.** Brown, R.A.; Busch, C.F. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Mar 1980. 227p. NTIS, PC A11/MF A01.

The report gives results of three studies at EPA's Multifuel Test Facility. The first evaluated a distributed-air staging concept for NOx control in pulverized-coal-fired systems. The second evaluated combustion control techniques and NO emissions when firing coal/oil mixtures. The third evaluated emissions and combustion characteristics of refuse-derived fuel (RDF) co-fired with either natural gas or pulverized coal.

14584 **(PB—80-178288) Technology assessment report for industrial boiler applications: fluidized-bed combustion. Final report, June 1978-July 1979.** Young, C.W.; Robinson, J.M.; Thunem, C.B.; Fennelly, P.F. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Nov 1979. 633p. NTIS, PC A99/MF A01.

The report gives results of an assessment of the applicability of atmospheric fluidized-bed combustion (AFBC) to industrial boilers. It is one of a series of reports to aid in determining the technological basis for a New Source Performance Standard for air pollutant emissions from the boilers. It reviews the development status and performance of SO_2, NOx, and particulate control options for AFBC; selects the most promising systems for control; and estimates the cost, energy, and environmental impacts of the most promising systems.

14585 **(PB—80-179286) Development study of a novel continuous-flow impactor. Final report, July 1976-November 1978.** Brooks, E.F.; Gat, N.; Taylor, M.E.; Chamberlain, T.E.; Golik, R.J. (TRW Systems and Energy, Redondo Beach, CA (USA)). Jan 1980. 127p. NTIS, PC A07/MF A01.

The report gives results of a development study involving feasibility verification of a novel particle impactor in which the impaction surface is the interface between two opposing jets. Particles (which would impact a solid surface in a standard impactor) cross the interface between the aerosol-laden gas and a previously particle-free gas, are entrained in the latter, and are conveyed out for analysis. Work consisted of an initial literature search and analysis to determine the likelihood of success, followed by design, fabrication, and testing of a laboratory unit. A good particle separation ca-

pability was demonstrated. Upon completion of the laboratory tests, a design effort showed the feasibility of a staged in situ particle monitoring subsystem to give semicontinuous (nominal 1 minute cycle time) output of particle size distribution, among other applications.

14586 **(PB—80-180953) Economic impact of changing emissions standards for explosive waste incinerators, R78-9. Final report.** Lynch, P.E. (Lynch (Patrick E.), Springfield, IL (USA)). Aug 1979. 49p. NTIS, PC A03/MF A01.

This report deals with the study of Olin Corporation which owns and operates a facility near Marion, Illinois. They produce waste materials contaminated by explosive chemicals. In order to dispose of the materials while complying with Chapter 2 of the Board's relations, Olin has the following options: (a) incinerate and clean the resulting effluents of particulate matter, (b) landfill, while taking all due precautions with respect to safety hazards, leaching, etc., (c) transport them out of state where they can be disposed in compliance with applicable regulations. Olin has chosen to dispose of such wastes through operation of two thermal incinerators followed by a wet venturi scrubber employing water as the scrubbant medium. The incinerated materials consist of explosive, low carbon wastes requiring large quantities of excess air for their safe, controlled combustion. This high excess air has the effect of diluting carbon dioxide concentrations in the effluent such that when allowable particulate emissions are corrected on the basis of only 12% carbon dioxide, particulate emissions are in violation of Rule 203 (e). Similarily, when carbon monoxide emission are computed, corrected for only 50% excess air, these emissions are in violation of Rule 206 (b).

14587 **(PB—80-181274) Photochemical study of NOx removal from stack gases. Final report, January 1977-March 1979.** Richards, J.R.; Fox, D.L. (North Carolina Univ., Chapel Hill (USA). School of Public Health). Mar 1980. 202p. NTIS, PC A10/MF A01.

The report gives results of an evaluation of the technical feasibility of a photochemical pretreatment system for NOx control at coal-fired boilers. The approach utilizes reaction mechanisms similar to those responsible for photochemical oxidant incidents. The reactions are initiated under controlled conditions while the pollutants are at high concentration and while the reaction products can be removed. Results indicate that, under time- and light-limited conditions, it is possible to quench the photochemical reactions at the NO_2 peak and prior to the formation of ozone, aerosols, and other secondary products. Photochemical oxidation of NO was insensitive to SO_2 concentration and CO_2 concentration. The photochemical system appears compatible with conditions resulting from combustion modifications to suppress NOx generation.

14588 **(PB—80-190515) Investigation of cars and laser-induced saturated fluorescence for practical combustion diagnosis. Final report Aug 78-Aug 79.** Eckbreth, A.C.; Bonczyk, P.A.; Verdieck, J.F. (United Technologies Research Center, East Hartford, CT (USA)). May 1980. Contract EPA-68-02-3105. 105p. NTIS, PC A06/MF A01.

The report gives results of experimental investigations aimed at developing nonperturbing, spatially precise, in-situ diagnostic techniques to measure species composition and temperature in flames. The investigations continued earlier development of coherent anti-Stokes Raman spectroscopy (CARS) and laser-induced saturated fluorescence. The program included two main, concurrent tasks. In Task 1, optical thermometry, the practical feasibility of CARS was demonstrated in a program of research-scale combustor testing (results agreed to within 5% for combustion zone temperature measurements made with CARS and with shielded thermocouples). In Task 2, optical composition, laser-induced saturated fluorescence was examined in regard to its capability for measuring CH, CN, and NO concentrations in flames. Saturation of the fluorescence in CH and CN was achieved and considerable insight into the physics of saturated fluorescence was obtained. Promising initial results of NO fluorescence in flames are described, but saturation was not observed for laser spectral intensities up to 6 million W/sq cm/cm.

14589 **(PB—80-193071) High resistivity behavior of hot-side electrostatic precipitators. Final report Oct 78-Oct 79.** Bickelhaupt, R.E. (Southern Research Inst., Birmingham, AL (USA)). Apr 1980. Contract EPA-68-02-2610. 40p. NTIS, PC A03/MF A01.

The report gives results of experiments to explain the high resistivity behavior of hot-side electrostatic precipitators (ESPs) collecting fly ash. The working hypothesis is that the behavior is the result of the buildup of a thin layer of sodium-ion-depleted fly ash which has a high electrical resistivity near the collector plate. The hypothesis was tested by experiments in a miniature corona discharge device under thermal and environmental conditions simulating a hot-side ESP. Current density-voltage curves were taken with positive-negative corona using a hand-placed ash layer 5 mm thick. Three major experiments were conducted to evaluate the effect on current density-voltage relationships of: long exposure to negative corona, long exposure to positive corona, and cyclic exposure to negative and positive corona.

14590 **(PB—80-194137) Electrostatic precipitation research in Japan.** Fisher, L.H. (Office of Naval Research Scientific Liaison Group, San Francisco, CA (USA)). Apr 1980. 60p. NTIS, PC A04/MF A01.

A review is provided of current Japanese research activities and trends involving the electrostatic removal of suspended particles, fumes, and mists from flowing gases. A general discussion of electrostatic precipitation principles and an historical overview of their application to pollution control is included. The background to Japanese interest in electrostatic precipitation technology is reviewed, and matrix under which research in this area is carried out in Japan is described. Also, a detailed review is provided of the activities of the Institute of Electrostatics and of the Electrostatics Laboratory at the University of Tokyo. Listings are included of the names and addresses of Japanese manufacturers of electrostatic precipitation equipment and of Japanese researchers in this field.

14591 **(PB—80-810435) Gas scrubbers used in pollution control. 1976-February, 1980 (citations from the American Petroleum Institute). Report for 1976-February 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). May 1980. 256p. NTIS PC N01/MF N01.

The citations from a worldwide literature survey relate to particle and gas scrubbers. The reports discuss design, performance, gas flow characteristics, and chemistry of the pollutants. Pollution control of SO_2, NOx, CO, Co_2, hydrocarbons, and particles is considered. (This updated bibliography contains 249 abstracts, 47 of which are new entries to the previous edition.)

4250 Power Cycles

14592 **(MDC-G—9290) Prototype nitinol heat engine. Final report.** McNichols, J.L. Jr.; Brookes, P.C.; Ginell, W.S.; Cory, J.S. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Nov 1980. Contract AC05-78OR06028. 130p. NTIS, PC A07/MF A01.

The principal objective of the program was to demonstrate that Nitinol heat engines can be scaled to higher powers. The approach was to build a series/parallel Nitinol thermoturbine engine based upon the principle of, and scaled up in power from, small ($\leqq$ 1 watt) single band thermoturbine engines which had previously been built and operated successfully. Equipment and instrumentation were built up for the measurements of the Nitinol helix force-length-temperature (FLT) behavior (state equation). Nitinol 20 mil diameter wire was wound in the form of 1 mm radius helical engine elements. The Nitinol elements were characterized and design equations, which relate engine performance to the Nitinol FLT properties and to machine dimensions, were used to perform engineering trade-offs to optimize performance and to specify engine component sizes, machine dimensions and heat source/sink requirements for optimal performance. A module engine was built with two series cycles and eighty parallel Nitinol helical bands. The module was instrumented so that performance could be monitored and diagnostic measurements could be made. The module operated successfully according to the design concept principles. The module

was tested for sink temperatures from ~ 9°C to 20°C and with source temperatures from ~ 50°C to ~ 75°C. Torque, power and frequency were measured. The peak shaft power output obtained during the performance testing of the series/parallel thermoturbine was greater than 32 watts. This power is the largest yet reported for Nitinol heat engines, is more than 30 times greater than the small single band engines previously built, and clearly demonstrated the feasibility of scaling Nitinol heat engines to larger powers.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

14593 **(SAND—80-2446C) High-intensity ion accelerators for inertial fusion.** Humphries, S. Jr.; Lockner, T.R.; Freeman, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 3p. (CONF-810314—16). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

Accelerator systems capable of driving inertial fusion targets are described. They are based on linear induction accelerator technology coupled with new methods of beam transport using electron neutralization of ion space charge. The resulting accelerators are modular and relatively compact. Typical unbunched output parameters of a beamline are 37 kA of Ne^+ at 150 MeV in a 60 ns pulse.

14594 **(UCID—18947) Plasmas in particle accelerators: adiabatic theories for bunched beams.** Mark, J.W.K. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 3 Mar 1981. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01.

Three different formalisms for discussing Vlasov's equation for bunched beam problems with anharmonic space charge forces are outlined. These correspond to the use of a drift kinetic equation averaged over random betatron motions; a fluidkinetic adiabatic regime analogous to the theory of Chew, Goldberger, and Low; and an adiabatic hydrodynamic theory.

4302 Beam Dynamics, Field Calculations, And Ion Optics

14595 **(LBL—12204) Heavy ion induction linacs for ICF.** Faltens, A.; Hartwig, E.; Hoyer, E.; Keefe, D.; Laslett, L.J.; Smith, L.; Bangerter, R.; Mark, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1980. Contract W-7405-ENG-48. 6p. (CONF-801248—1). NTIS, PC A02/MF A01.

From 4. American Nuclear Society topical meeting on technology of controlled nuclear fusion; Valley Forge, PA, USA (14 Dec 1980).

A review of some of the main characteristics of present day induction linacs is given. (MOW)

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 14623, 14941

14596 **(ANL-HEP-CP—80-20) Hybrid shower counter for CDF.** Nodulman, L. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 11p. (CONF-800243—7). NTIS, PC A02/MF A01.

From Wire chamber conference; Vienna, Austria (27 Feb 1980).

A hybrid scintillator/strip chamber electromagnetic calorimeter has been proposed for the Collider Detector Facility at Fermilab. Large modules of lead/scintillator with wavebar readout are to contain one or more bidimensional wire chambers near shower maximum. Results of the ongoing program of computer simulation and prototype testing are discussed.

14597 **(DOE/ER/01067—19) Triangle Universities Nuclear Laboratory annual report, 1 January 1980-31 December 1980.** (Triangle Universities Nuclear Lab., Durham, NC (USA)). 1980. Contract AC05-76ER01067. 233p. NTIS, PC A11/MF A01.

Research is described for: neutron cross section experiments; neutron polarization studies; high resolution elastic and inelastic scattering studies; charged particle experiments with polarized beams; radioactive capture reactions; accelerator based atomic physics; instrumentation; computer related development; and nuclear theory and phenomenology. (GHT)

14598 **(Juel-Conf—34) Targets for neutron beam spallation sources.** Bauer, G.S. (ed.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Jan 1980. 215p. (CONF-8006143—). NTIS (US Sales Only), PC A10/MF A01.

From Meeting on targets for neutron beam spallation sources; Juelich, F.R. Germany (11 Jan 1980).

The meeting on Targets for Neutron Beam Spallation Sources held at the Institut fuer Festkoerperforschung at KFA Juelich on June 11 and 12, 1979 was planned as an informal get-together for scientists involved in the planning, design and future use of spallation neutron sources in Europe. These proceedings contain the papers contributed to this meeting. For further information see relevant topics in the Subject Index.

14599 **(LA-UR—81-408) Buncher system parameter optimization.** Wadlinger, E.A. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 4p. (CONF-810314—14). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

A least-squares algorithm is presented to calculate the RF amplitudes and cavity spacings for a series of buncher cavities each resonating at a frequency that is a multiple of a fundamental frequency of interest. The longitudinal phase-space distribution, obtained by particle tracing through the bunching system, is compared to a desired distribution function of energy and phase. The buncher cavity parameters are adjusted to minimize the difference between these two distributions. Examples are given for zero space charge. The manner in which the method can be extended to include space charge using the 3-D space-charge calculation procedure is indicated.

14600 **(LA-UR—81-421) FMIT prototype linac tank.** Coops, W. (Los Alamos Scientific Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 4p. (CONF-810314—15). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

The prototype linac tank (PLT) is an assembly of many components. This paper is limited to a discussion of the shell, and not the attaching components. Basically, the shell consists of an 8-ft-diam by 12-ft-long copper-lined tube. Despite the simplicity of this description, many special features not used nor needed in pulsed accelerators have been incorporated into this design, to handle the continuous duty cycle and high radiation levels expected for the Fusion Materials Irradiation (FMIT) Facility. The shell has been made a part of the development hardware package, not because the shell needed design development, but to allow testing and proving of other attaching hardware.

14601 **(LBL—11957) Future prospects of the TPC idea.** Nygren, D.R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1980. Contract W-7405-ENG-48. 29p. (CONF-800684—10). NTIS, PC A03/MF A01.

From International conference on experimentation at LEP; Uppsala, Sweden (16 Jun 1980).

General aspects affecting TPC size, readout plane characteristics and operation in the LEP environment are presented, with the general conclusion that modest improvements relative to PEP-4 can be realized in several areas. The problem of positive ion reduction is discussed according to two qualitatively new operating modes, asynchronous and synchronous gating. Either gating mode appears to offer a means to eliminate almost completely the ion return flux. Some speculative ideas involving 3-component gas mix-

tures, low-mass components and parallel plane geometry are presented as future possibilities.

14602 **(SAND—80-2492C) IFA-2 collective accelerator.** Olson, C.L.; Woodworth, J.R.; Frost, C.A.; Gerber, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 16p. (CONF-810314—13). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

IFA proof-of-principle experiments (completed on the IFA-1 system) have already demonstrated accurately-controlled motion of the potential well at the head of an IREB, and IFA ion data sets (H^+, D^+, He^{++}) imply that controlled accelerating fields of 50 MV/m have been achieved over 10 cm. A new system, IFA-2, is being developed to demonstrate controlled accelerating fields of 100 MV/m over 1 meter. For IFA-2, a new working gas (N,N dimethyl aniline) has been found that operates at room temperature and requires only one laser (XeCl-307 nm). This new working gas represents a major breakthrough for the IFA in regard to simplicity and ease of operation. Research on this new working gas (IREB-induced ionization cross section experiments, photoionization cross section experiments), and the status of the IFA-2 system, are discussed.

14603 **(SAND—81-0362C) Effects of anode spot heat transfer on vacuum arc behavior.** Benson, D.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 20p. (CONF-810224—1). NTIS, PC A02/MF A01.

From Process technology review meeting; Albuquerque, NM, USA (12 Feb 1981).

Vaporization of anode material by a plasma in a vacuum arc is a source of ions for neutron tube applications. This report analytically describes this vaporization behavior to increase the understanding of tube performance. A model which balances heat input from the plasma against losses due to vaporization, radiation and conduction within the anode material is used. The anode spot heating by the plasma is described by a simple power feedback model. These calculations are then compared to previous surface temperature measurements on anode spots in an ion source. Examples of parametric analyses showing the effect of material property variations of the arc behavior are described.

14604 **(SLAC-PUB—2647) Drift and proportional tracking chambers.** Jaros, J.A. (Stanford Linear Accelerator Center, CA (USA)). Nov 1980. Contract AC03-76SF00515. 40p. (CONF-800782—2). NTIS, PC A03/MF A01.

From SLAC/Summer Institute conference on the weak interaction; Menlo Park, CA, USA (28 Jul 1980).

Many techniques have been exploited in constructing tracking chambers, particle detectors which measure the trajectories and momenta of charged particles. The particular features of high-energy interactions - charged particle multiplicities, angular correlations and complex vertex topologies, to name a few - and the experimental environment of the accelerator - event rates, background rates, and so on - accent the importance of certain detector characteristics. In high energy e^+e^-, anti pp and pp interactions the final states are dominated by closely collimated jets of high multiplicity, requiring good track-pair resolution in the tracking chamber. High energy particles deflect very little in limited magnetic field volumes, necessitating good spatial resolution for accurate momentum measurements. The colliding beam technique generally requires a device easily adapted to full solid-angle coverage, and the high event rates expected in some of these machines put a premium on good time resolution. Finally, the production and subsequent decays of the tau, charmed and beautiful mesons will provide multiple vertex topologies. To reconstruct these vertices reliably will require considerable improvements in spatial resolution and track-pair resolution. This lecture considers the proportional counter and its descendant, the drift chamber, as tracking chambers. Its goal is to review the physics of this device in order to understand its performance limitations and promises.

14605 **Electron suppression in a multicusp negative ion source.** Ehlers, K.W.; Leung, K.N. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). W-7405-ENG-48. *Applied Physics Letters ;* **38**: No. 4, 287-289(15 Feb 1981).

Three different techniques for reducing the background electron density at the exit region of a multicusp negative ion source are described.

4304 Storage Rings

14606 **(BNL—29055) Radiation heating from beam loss on ISABELLE ejection septa.** Stevens, A.J. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 9p. (CONF-810314—17). NTIS, PC A02/MF A01.

From Particle accelerator conference; Washington, DC, USA (11 Mar 1981).

It is anticipated that radiation heating due to beam loss may place severe constraints on the operation of high energy accelerators which utilize superconducting magnets. Losses on ejection septa, assuming an unbunched beam mode of operation, are unavoidable and have direct impact on the design of the extraction system. Calculations of energy deposition densities downstream of ISABELLE ejection septa have been made using a modified version of the hadron cascade Monte Carlo computer program CASIM. The results of these calculations are described, giving emphasis to understanding the physical processes which dominate the energy deposition as a function of lattice geometry, which may include the presence of collimators. It is found that fast forward protons are particularly troublesome, since they are focused by the lattice until a dispersive element is reached. At 400 GeV/c, these leading particles produce an energy density of approximately 5 x 10^{-8} GeV/(cm_{SP}) in the coils of ISABELLE dipoles, which implies that septum losses be less than 0.1% of the circulating beam if quenches are to be avoided.

14607 **Aspects of a new light source.** Bagley, G.P. (Brookhaven National Lab., Upton, NY). Contract EY-76-C-02-0016. *Journal of the National Technical Association ;* **54**: No. 3, 96-101(Sum 1980).

The National Synchrotron Light Source, under construction at Brookhaven Laboratory, will be a uniquely copious source of x-ray and ultraviolet photons with a wide spectrum. Some of the potential uses of this intense radiation include studies of absorption spectra, photoemission of electrons, x-ray scattering, biochemical studies and other areas of basic research. It can also be used for micro-lithography of integrated circuits for ultra dense semiconductor devices. The basic operation of the electron synchrotron is described. This includes the three step acceleration of the electrons thru a linear accelerator, a booster synchrotron and finally in a synchrotron storage ring. The synchrotron magnet power system, the responsibility of a black engineer, is described. An SCR chopper approach is used with precision components to achieve current stability and repeatability of .01%. This current generates the magnetic fields which bend and focus the electron beam.

44 INSTRUMENTATION

4401 Radiation Instrumentation

14608 **(ANL-HEP-CP—80-34) Analog and digital-multistage time-averaging filters.** Theodosiou, G.E.; Dawson, J.W. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 19p. (CONF-800684—11). NTIS, PC A02/MF A01.

From International conference on experimentation at LEP; Uppsala, Sweden (16 Jun 1980).

In time measurements involved in the detection of elementary particles using large counters, the time uncertainty introduced by the finite propagation velocity of the produced signal may be significant compared to the desired time resolution. A novel method, the essential ingredients of which are the time properties of delay lines and AND and OR logic gates, is introduced to

reduce this effect drastically. The basic circuit is described, and then the synthesis of time averaging filters, a four-stage filter (implementation and testing), experimental results, and future applications are discussed. The problem of precise timing with a counter of large dimensions can also be solved by means of an analog method; the principle involved, implementation, testing, and time resolution and deadtime are considered. (RWR) 7 figures

14609 **(ANL-HEP-PR—80-02) 50 MeV polarimeter.** Spinka, H. (Argonne National Lab., IL (USA)). 15 Apr 1980. Contract W-31-109-ENG-38. 38p. NTIS, PC A03/MF A01.

A description is given of the construction, operation and calibration of the 50 MeV polarimeter which was used at the ZGS. The dependence of the observed counts on various parameters, including the beam polarization, beam intensity and the solid angle in the two polarimeter arms is also discussed.

14610 **^{207}Bi light pulser for stabilization of scintillation and lead glass Cherenkov detectors.** Bolton, R.D.; Baer, H.W.; Bowman, I.D.; Gordon, L. (Los Alamos Scientific Lab., NM (USA). Medium Energy Physics Div.). *Nuclear Instruments amp Methods ;* **174**: No. 3, 411-419(Aug 1980).

The design, fabrication techniques, and performance parameters are presented for a light pulser consisting of radioactive ^{207}Bi embedded in capsulses of various types of plastic scintillator material. A typical resolution of 16% (fwhm) for the 0.974 MeV conversion electron line was obtained. A method whereby the contribution to the resolution due to photoelectron statistics can be reparated from the total measured resolution is described. An application of these pulsers to the stabilization of an array of 60 lead glass counters is described.

14611 **(IAEA-TECDOC—221) Current status of neutron spectrum unfolding.** (International Atomic Energy Agency, Vienna (Austria)). 1979. 283p. (CONF-771096—). NTIS (US Sales Only), PC A13/MF A01.

From Meeting on current status of neutron spectrum unfolding; Oak Ridge, TN, USA (10 Oct 1977).

Papers from this meting were processed individually for the data base as they were received from INIS. (RWR)

14612 (IAEA-TECDOC—221, pp 151-159) **Modifying factor in unfolding.** Zijp, W.L.; Rieffle, H.C. (Stichting Energieonderzoek Centrum Nederland, Petten). 1979.

From Technical committee meeting on current status of neutron spectrum unfolding; Oak Ridge, TN, USA (10 - 12 Oct 1977).

The algorithm of the SAND-II unfolding program allows the study of the influence of a single detection reaction in adjusting for each energy group the flux density, when the input data for the unfolding process are available. The components of the modifying factor are considered. Some preliminary experience is presented.

14613 (IAEA-TECDOC—221, pp 161-166) **Certainty parameter in unfolding.** Zijp, W.L.; Rieffle, H.C. (Stichting Energieonderzoek Centrum Nederland, Petten). 1979.

From Technical committee meeting on current status of neutron spectrum unfolding; Oak Ridge, TN, USA (10 - 12 Oct 1977).

A new parameter is studied which gives the relative change in the sum of squares of deviation for a relative change in the group flux density. Large values for this certainty parameter indicate close bounds for the solution spectrum. Small or zero values indicate that for those regions large variations in the solution have little or no effect on the sum of squares, so that wide margins in the solutions are allowed. The parameter can in principle be applied to all unfolding programs.

14614 **(PB—80-808702) Bubble chambers. 1970-1980 (citations from the Engineering Index Data Base). Report for 1970-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 132p. NTIS PC N01/MF N01.

Cited articles describe the design, construction, and use of several types of bubble chambers for the detection of particle radiation. Also included are articles on bubble chamber diagnostic equipment, film analysis techniques, and data reduction methods using computers. (Contains 134 citations)

14615 **Air-ground interface effect on gamma-ray submersion dose.** Ryman, J.C. (Oak Ridge National Lab., TN); Faw, R.E.; Shultis, J.K. *Transactions of the American Nuclear Society ;* **34**: 666-668(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14616 **Trends and developments in personnel neutron dosimetry.** Griffith, R.V. (Univ. of California, Livermore). *Transactions of the American Nuclear Society ;* **34**: 621(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14617 **Nuclear track counting determinations of boron distributions in optical waveguide glasses.** Mitchell, J.W. (Bell Labs., Murray Hill, NJ); Carpenter, B.S. *Transactions of the American Nuclear Society ;* **34**: 143-144(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14618 **Solid-state track recorder applications in US nuclear reactor energy programs.** Gold, R.; Ruddy, F.H.; Roberts, J.H. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 146-148(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

14619 **IEEE annual conference on nuclear and space radiation effects, 1979.** Bombardt, J.; McGarrity, J.M. (eds.). (Research and Development Associates, Arlington, VA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-26**: No. 6, 4709-5184(Dec 1979). (CONF-790706—).

From 1979 IEEE Annual conference on nuclear and space radiation effects; Santa Cruz, CA, USA (17 Jul 1979).

This conference proceedings contains 78 papers all of which are indexed separately. Topics covered include: basic radiation mechanisms in materials and devices; energy deposition and dosimetry; system responses from SGEMP, IEMP, and EMP; basic processes in SGEMP, IEMP, and EMP; radiation effects in MOS microcircuits; and space radiation effects and spacecraft charging.

14620 **Experimental study of transient annealing in I^2L devices following pulsed neutron irradiation.** Rieden, R.F. (Sandia Labs., Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-26**: No. 6, 4775-4777(Dec 1979). (CONF-790706—).

From 1979 IEEE Annual conference on nuclear and space radiation effects; Santa Cruz, CA, USA (17 Jul 1979).

A series of experiments has been performed to determine the annealing factor for I^2L devices at 23°C. The devices used in these experiments are representative of Second-Generation-Oxide-Separated I^2L technology. The devices were irradiated using the SPR reactors. The annealing factor was obtained through the use of several electrical parameters and the value obtained was greater than 1.7 at a time of 50 μs after the peak of the neutron irradiation pulse and decayed down to a value of 1.1 at a time of 1s after the peak of the pulse.

14621 **Neutron irradiation for prevention of latch-up in MOS integrated circuits.** Adams, J.R.; Sokel, R.J. (Sandia Labs., Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science ;* **NS-26**: No. 6, 5069-5073(Dec 1979). (CONF-790706—).

From 1979 IEEE Annual conference on nuclear and space radiation effects; Santa Cruz, CA, USA (17 Jul 1979).

Bulk silicon integrated circuits can exhibit latch-up effects which arise from regenerative switching in the parasitic bipolar

transistors inherent in the complex circuit configurations. This is especially true for bulk CMOS integrated circuits in which parasitic vertical NPN and lateral PNP bipolars are connected in an SCR fashion. One method for preventing latch-up is lifetime control utilizing neutron irradiation. This work characterizes the long-term annealing of neutron irradiation induced changes in the parasitic bipolar gains of MOS/LSI integrated circuits. A theoretical model, which fits both isothermal and isochronal annealing data, is used to characterize the annealing. Using this model, a procedure has been established for neutron irradiation of LSI integrated circuits which will guarantee that latch-up will not occur during the normal lifetime of the circuits.

14622 **Degradation of radiation hardness in CMOS integrated circuits passivated with plasma-deposited silicon nitride.** Anderson, R.E. (Sandia Labs., Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science* ; NS-26: No. 6, 5180-5184(Dec 1979). (CONF-790706—).

From 1979 IEEE Annual conference on nuclear and space radiation effects; Santa Cruz, CA, USA (17 Jul 1979).

The sensitivity of metal gate CMOS integrated circuits to ionizing radiation is shown to be affected by the final passivation employed. Specifically, plasma-deposited silicon nitride produces an unexpected degradation in radiation hardness due to the generation of charged surface states at the Si-SiO_2 interface. The relationship between the silicon nitride deposition temperature and device threshold voltage shifts is explored as well as the effects of post-passivation anneals. These results indicate that several mechanisms are responsible for the hardness degradation, with effects due to hydrogen diffusion appearing to be of central importance.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 13886, 14426, 14427, 14565

14623 **(CONF-810420—1) Automating an EXAFS facility: hardware and software considerations.** Georgopoulos, P.; Sayers, D.E.; Bunker, B.; Elam, T.; Grote, W.A. (Argonne National Lab., IL (USA); North Carolina State Univ., Raleigh (USA). Dept. of Physics; Washington Univ., Seattle (USA). Dept. of Physics; Monsanto Corp., St. Louis, MO (USA). Physical Sciences Center). 1981. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01.

From Workshop on laboratory EXAFS facilities and their relation to synchrotron radiation sources; Seattle, WA, USA (28 Apr 1981).

The basic design considerations for computer hardware and software, applicable not only to laboratory EXAFS facilities, but also to synchrotron installations, are reviewed. Uniformity and standardization of both hardware configurations and program packages for data collection and analysis are heavily emphasized. Specific recommendations are made with respect to choice of computers, peripherals, and interfaces, and guidelines for the development of software packages are set forth. A description of two working computer-interfaced EXAFS facilities is presented which can serve as prototypes for future developments. 3 figures.

14624 **(LA-UR—81-513) Measuring sphericity on a roundness gage.** Gauler, A.L. (Los Alamos Scientific Lab., NM (USA)). 1980. Contract W-7405-ENG-36. 20p. (CONF-8010160—1). NTIS, PC A02/MF A01.

From 52. IMOG gaging subgroup meeting; Los Alamos, NM, USA (21 Oct 1980).

The three-dimensional geometry of a spherical object may be determined by evaluation of a number of two-dimensional roundness measurements which have a known orientation with respect to one another. A suitable set of orientations appears to be one in which the plane of each roundness measurement coincides with every other such plane along a single diameter of the sphere. A device for producing the required set of orientations, adaptable to spheres of varying diameters and designed to avoid damage to delicate materials, has been developed and tested.

14625 **(LBL—8789) Sensitivity and response time improvements in millimeter-wave spectrometers.** Kolbe, W.F.; Leskovar, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1980. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01.

A new version of a microwave spectrometer for the detection of gaseous pollutants and other atmospheric constituents is described. The spectrometer, which operates in the vicinity of 70 GHz, employs a Fabry-Perot resonator as a sample cell and uses superhetrodyne detection for high sensitivity. The spectrometer has been modified to incorporate a frequency doubler modulated at 30 MHz to permit operation with a single Gunn oscillator source. As a result, faster response time and somewhat greater sensitivity are obtained. The spectrometer is capable of detecting a minimum concentration of 1 ppM of SO_2 diluted in air with a 1 second time constant. For OCS diluted in air, the minimum detectable concentration is 800 ppB and with a 10 second time constant 300 ppB.

14626 **(SAND—80-2655) Error analysis of thermocouple measurements in the Radiant Heat Facility.** Nakos, J.T.; Strait, B.G. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1980. Contract AC04-76DP00789. 58p. NTIS, PC A04/MF A01.

The measurement most frequently made in the Radiant Heat Facility is temperature, and the transducer which is used almost exclusively is the thermocouple. Other methods, such as resistance thermometers and thermistors, are used but very rarely. Since a majority of the information gathered at Radiant Heat is from thermocouples, a reasonable measure of the quality of the measurements made at the facility is the accuracy of the thermocouple temperature data.

14627 **(SAND—80-2659C) High-temperature measurements of Q-factor in rotated X-cut quartz resonators.** Fritz, I.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 3p. (CONF-810316—3). NTIS, PC A02/MF A01.

From High temperature electronics conference; Tucson, AZ, USA (25 Mar 1981).

The Q-factors of piezoelectric resonators fabricated from natural and synthetic quartz with a 34° rotated X-cut orientation have been measured at temperatures up to 325°C. The synthetic material, which was purified by electrolysis, retains a high enough Q to be suitable for high-temperature pressure transducer applications, whereas the natural quartz is excessively lossy above ~ 200°C for this application. The present results are compared to results obtained previously on AT-cut resonators.

14628 **Comment on "Sample-gas thermal contact resistance and the photoacoustic signal generation".** Rosencwaig, A. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *Journal of Applied Physics* ; 52: No. 1, 503-504(Jan 1981).

The dependence on the thermal properties of the gas in a photoacoustic cell predicted by the sample-gas thermal resistance theory is also predicted by the Rosencwaig-Gersho theory for very thin samples.

4404 Well Logging Instrumentation

14629 **(LA-UR—81-400) Computer model for calculating gamma-ray pulse-height spectra for logging applications.** Evans, M.L. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 14p. (CONF-810228—1). NTIS, PC A02/MF A01.

From Gamma-ray logging workshop; Grand Junction, CO, USA (17 Feb 1981).

A generalized computer model has been devised to simulate the emission, transport, and detection of natural gamma radiation from various logging environments. The model yields high-resolution gamma-ray pulse-height spectra that can be used to correct both gross gamma and spectral gamma-ray logs. The technique can help provide corrections to airborne and surface radiometric survey logs for the effects of varying altitude, formation composition, and overburden. Applied to borehole logging, the model can yield esti-

mates of the effects of varying borehole fluid and casing attenuations, as well as varying formation porosity and saturation.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

14630 **(LA—8647) Jet initiation of explosives.** Mader, C.L.; Pimbley, G.H. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 11p. NTIS, PC A02/MF A01.

The initiation of propagating detonation in PBX 9502 and PBX 9404 by jets of copper, aluminum, and water is numerically modeled using the two-dimensional Eulerian hydrodynamic code 2DE with the shock initiation of heterogeneous explosive burn model called Forest Fire. The Held experimental critical condition for propagating detonation is the jet velocity squared times the jet diameter. In PBX 9502, the jets initiate an overdriven detonation smaller than the critical diameter, which either fails or enlarges to greater than the critical diameter while the overdriven detonation decays to the C-J state. In PBX 9404 the jet initiates a detonation that propagates only if it is maintained by the jet for an interval sufficient to establish a stable curved detonation front.

14631 **(LA—8655) Three-dimensional modeling of triple-wave initiation of insensitive explosives.** Mader, C.L.; Kershner, J.D. (Los Alamos National Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01.

The initiation of propagating detonation in the insensitive explosive PBX 9502 (95/5 TATB/Kel-F at 1.894 g/cm^3) by triple-shock-wave interaction from three initiators has been modeled using the three-dimensional, reactive, Eulerian hydrodynamic code, 3DE. The Forest Fire burn model of heterogeneous explosive shock initiation was used to model the explosive decomposition.

14632 **(UCRL—85120(Vol.1)) Dynamic mechanical and molecular weight measurements on polymer bonded explosives from thermally accelerated aging tests. I. Fluoropolymer binders.** Hoffman, D.M.; Caley, L.E. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1981. Contract W-7405-ENG-48. 13p. (CONF-810308—6). NTIS, PC A02/MF A01.

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

The dynamic mechanical properties and molecular weight distribution of two polymer bonded explosives, LX-10-1 and PBX-9502, maintained at 23, 60, and 74°C for 3 years were studied. LX-10-1 is 94.5% 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane explosive bonded together with 5.5% Viton A fluoropolymer. PBX-9502 is 95% triaminotrinitrobenzene explosive bonded with 5% Kel-F-800 fluoropolymer. There are two mechanical relaxations in the LX-10-1 in the military temperature range. The relaxation at -10°C is associated with the glass transition temperature of the Viton A binder. A second weak relaxation occurs at about 30°C in all LX-10-1 samples tested. This relaxation is probably associated with small amounts of crystallinity in the binder although this has not been demonstrated. There is a slight increase in modulus of the LX-10-1 with accelerated aging temperature. Changes in the dynamic mechanical properties of PBX-9502 are ascribed to crystallization of the chlorotrifluoroethylene component of the Kel-F-800 binder. The molecular weight of the Viton A binder decreased slight with increasing aging temperature. Using the kinetics of random scission the activation energy for polymer degradation in the presence of the explosive was 1.19 kcal/mole. The Arrhenius preexponential term and activation energy predict an expected use-life in excess of 60 years for LX-10-1. The Kel-F-800 in PBX-9502 is also extremely stable.

14633 **(UCRL—85120(Vol.2)) Dynamic mechanical and molecular weight measurements on polymer bonded explosives from thermally accelerated aging tests. II. A poly(ester-urethane) binder.** Hoffman, D.M.; Caley, L.E. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1981. Contract W-7405-ENG-48. 10p. (CONF-810308—4). NTIS, PC A02/MF A01.

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

The molecular weight distribution and dynamic mechanical properties of an experimental polymer-bonded explosive, X-0282, maintained at 23, 60, and 74°C for 3.75 y were examined, X-0282 is 95.5% 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclo-octane explosive and 4.5% Estane 5703, a segmented poly(ester-urethane). Two mechanical relaxations at about -24 and 42°C were found in the X-0282 aged at room temperature for 3.75 years. A third relaxation at about 85°C was found in X-0282 aged at 60 and 74°C. The relaxation at -24°C is associated with the soft segment glass transition of the binder. The relaxation at 42°C is associated with the soft segment melting and may also contain a component due to the hard segment glass transition. The relaxation at 85°C is probably associated with improved soft segment crystallite perfection. The molecular weight of the poly(ester-urethane) binder decreased significantly with increasing accelerated aging temperature. A simple random chain scission model of the urethane degradation kinetics in the presence of explosive yields an activation energy of 11.6 kcal/mole. This model predicts a use life of about 17.5 years under the worst military operating conditions (continuous operation at 74°C).

14634 **(UCRL—85120(Vol.3)) Dynamic mechanical and molecular weight measurements on polymer bonded explosives from thermally accelerated aging tests. III. Kraton block copolymer binder and plasticizers.** Caley, L.E.; Hoffman, D.M. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 1981. Contract W-7405-ENG-48. 11p. (CONF-810308—5). NTIS, PC A02/MF A01.

From American Chemical Society symposium on the chemistry of engine combustion deposits; Atlanta, GA, USA (29 Mar 1981).

The dynamic mechanical properties and molecular weight distribution of two experimental polymer bonded explosives, X-0287 and X-0298, maintained at 23, 60, and 74°C for 3 years were examined. X-0287 is 97% 1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane explosive, 1.8% Kraton G-1650, and 1.2% B^2 was 170. X-0298 is 97.4% explosive, 1.4% Kraton G-1650, and 1.2% Cenco Hi-vac oil. The relaxation associated with the Kraton rubber block glass transition is observed in both X-0287 and X-0298. In the unaged X-0298 it occurs at -59°C and in the aged explosive at 50°C. This is caused by migration of the oil plasticizer out of the explosive. In X-0287 the Kraton rubber block T/sub g/ is weak and broad due to the presence of the wax plasticizer. X-0287 has a second broad relaxation associated with the melting of the wax from 10 to 65°C. The molecular weight of the Kraton binder decreased with increasing accelerated aging temperature. The oil plasticizer had no stabilizing effect, but below its melting point the wax reduced Kraton chain scission considerably. The simple random chain scission model predicted a 20.5 year use-life for X-0298, but X-0287 was stabilized against degradation below the wax melting point.

4502 Nuclear

14635 **(AD—362111) Structural response of F-84F aircraft in flight.** Purkey, G.F.; Mitchell, R.F. (Cook Research Labs., Skokie, IL (USA)). 18 Jul 1958. 97p. NTIS, PC A05/MF A01.

The objective of this project was to determine, through an experimental investigation, the structural response of the F-84F type aircraft when exposed during flight to the effects of a nuclear explosion. Specifically, the program was arranged to secure fundamental data on: (1) relationships between weapon yield, aircraft placement, orientation, and aircraft structural responses; (2) resultant stresses caused by thermal radiation impinging upon the aircraft; (3) aerodynamic cooling effect; (4) magnitude and effect of skin temperature rise with varying angle of incidence; and (5) effect of asymmetrical loading on aircraft structure by a side blast.

14636 **(AD-A—0897181) MISERS BLUFF ground spall investigation. Final report, 1 July-31 October 1978.** Linnerud, H. (JAYCOR, Woburn, MA (USA)). 10 Nov 1978. 38p. NTIS, PC A03/MF A01.

This report describes the fielding of an experiment on the MISER BLUFF Phase II events to quantify the driving parameters behind a shock-driven ground spall phenomenon observed on Phase I events. A detailed background for the experiment is presented in Section II, while the next sections provide details on the deployment of the experiment and the subsequent data acquisition. The report concludes by recognizing that the primary data acquisition instrumentation (cameras deployed by the Denver Research Institute) did not acquire any information because the events created dust clouds which completely obliterated the test areas. The secondary data, net disc displacement, is reported to be too sparse, and to have too much scatter, to permit the derivation of valid correlations. The report concludes with a recommendation that the measurement be attempted again on the next series of explosive events, or perhaps that a small experiment be mounted to obtain similar information from a laboratory shock tube.

14637 **(PB—80-197080) Psychological deterrents to nuclear theft: an updated literature review and bibliography.** Lapinsky, G.W. Jr.; Goodman, C. (National Bureau of Standards, Washington, DC (USA)). May 1980. 47p. NTIS, PC A03/MF A01.

A review of the unclassified literature dealing with psychological deterrents was conducted for the Defense Nuclear Agency (DNA). The review indicates that while human psychological processes (sensory, perceptual, and cognitive) can be manipulated by various means, definitive empirical data are lacking which directly relate to deterring nuclear weapon theft. Behavioral impact research should be undertaken by DNA to ascertain the deterrence values of the many techniques identified.

14638 **(SAND—81-0502C) Comparison of ground motion from nuclear weapons tests at surface and at depth.** Vortman, L.J. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 39p. (CONF-810225—1). NTIS, PC A03/MF A01.

From Workshop on seismic performance of underground facilities; Augusta, GA, USA (11 Feb 1981).

Sandia National Laboratories has at the Nevada Test Site seven stations at which ground motion measurements are made at the surface and at depth. The bottom measurements are made in drill holes except for two locations where they are in drifts. The depths vary from 130m to 762m and the number of top/bottom pairs varies from a minimum of 5 events for one location to a maximum of 26 events for another. At each top/bottom location, three orthogonal components of acceleration are measured and velocity and displacement time histories are obtained from first and second integrations of the acceleration records. Examples have been chosen for two locations using motion generated by the HEARTS event which was detonated in tuff at 640m at a location where the alluvium/tuff interface was at 296m, the tuff/paleozoic at 1071m, and the static water level at 507m. The measured data are presented and analyzed. It was concluded that accelerations are suppressed most and displacements least and amount of the difference between top and bottom is very site-dependent with some dependence on transmission path geology and presumably less dependence on source location and geology. (LCL)

4503 Explosion Detection

14639 **(AD-A—088832) Near-source phenomena and their manifestations on signatures of more distant radiation of seismic energy. Final report.** Apsel, R.J.; Rawson, G.; Frazier, G.A.; Fried, J.C.; Sweet, J. (Del Mar Technical Associates, CA (USA)). 30 May 1980. 438p. NTIS, PC A19/MF A01.

A systematic analysis of buried explosions is performed for the purpose of determining how near-source effects influence seismic observations. Analytical Green's function methods are developed and used to efficiently and accurately extend representations of seismic radiaton to the far-field domain of interest. Representations of nonlinear processes and near-source inhomogeneities are provided that simplify the complexities of near-source explosion/earth interactions while still allowing for important near-source variations. The theoretical/computational program is conducted in parallel with a review/interpretative program of empirical data from a broad suite of geologic settings.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

14640 **(PB—80-198492) Research programmes in environmental engineering and science in India.** Sundaresan, B.B.; Kesarwani, S.K.; Bhat, S.G. (National Environmental Engineering Research Inst., Nagpur (India)). 1978. 327p. NTIS, PC A15/MF A01.

This publication provides information about the ongoing research projects in the field of Environmental Engineering and Science in India. It contains information on 462 research projects carried out by abut 893 scientists working in different organizations.

5001 Basic Studies

REFER ALSO TO CITATION(S) 14876

14641 **(PB—80-174873) Summary report of the ncaq atmospheric dispersion modeling panel. Volume 2. Background and supporting material. Final report.** Chandler, M.W.; Lewis, J.; Zalcman, B.; Kelly, J.I.; Nugent, A.E. (Dames and Moore, Bethesda, MD (USA)). Mar 1980. 188p. NTIS, PC A09/MF A01.

This is volume 2 of a two-volume report of a 22-member Atmospheric Dispersion Modeling Panel convened by the National Commission on Air Quality to provide guidance on: (1) uses and limitations of currently available models for air quality management; and, (2) appropriate dispersion models and/or technical approaches to be considered in the Commission's evaluation of the Clean Air Act through five comprehensive regional studies (Los Angeles area, Four Corners area, Minneapolis/St. Paul area, New York/Hartford, CT. area, and the Ohio River Valley from Louisville to Cincinnati). Volume 2 contains background and supporting material provided to Panel participants.

14642 **(PB—80-175102) Modeling of simulated photochemical smog with kinetic mechanisms. Volume 1. Final report, July 1978-September 1979.** Whitten, G.Z.; Killus, J.P.; Hogo, H. (Systems Applications, Inc., San Rafael, CA (USA)). Feb 1980. 364p. NTIS, PC A16/MF A01.

Mechanisms that describe the formation of photochemical smog are developed using a computer modeling technique directed toward the simulation of data collected in two smog chambers: an indoor chamber and a dual outdoor chamber. The results of simulating 164 different experiments are presented in Vol. 1. Individual compounds for which specific experiments were simulated and mechanisms developed include the following: formaldehyde, acetaldehyde, ethylene, propylene, butane, and toluene. Experiments in both chambers were simulated for all these compounds. The mechanisms reported describe the decay of the precursor organic compound, formation and decay of secondary organic compounds, conversion of nitrogen oxides, formation of nitrates, and the appearance and decay of ozone. Special emphasis is given to the chemistry of toluene. Also included is a study of a generalized smog-based or carbon-bond mechanism developed in a previous study.

14643 **(PB—80-176787) Kinetic studies of simulated polluted atmospheres. Final report January 1976-April 1979.** Calvert, J.G. (Ohio State Univ., Columbus (USA). Dept. of Chemistry). Jan 1980. 281p. NTIS, PC A13/MF A01.

The kinetics and reaction mechanisms of several important atmospheric contaminants - SO2, formaldehyde, nitrous acid, and the nitrosamines - were assessed to help quantify some key aspects of the chemistry of polluted atmospheres. The reactions and lifetimes of excited sulfur dioxide with various atmospheric components including hydroxyl, hydroperoxy, and methylperoxy radicals were studied. These data and other published rate data were reviewed and evaluated. The photolysis of formaldehyde was investigated as a major source of hydroperoxyl radicals, and a quantitative

evaluation made of its apparent first order rate constants at various solar zenith angles. The absolute extinction coefficients for nitrous acid were determined, and estimates made of the rates of hydroxyl radical generation in the troposphere by photolysis of nitrous acid. Long path Fourier transform infrared spectroscopy was used to help evaluate the potential for nitrosamine formation in the polluted atmosphere.

14644 **(PB—80-178346) Evaluation of the real-time air-quality model using the RAPS (regional air pollution study) data base. Volume 1. Overview. Final report August 1977-April 1979.** Ruff, R.E. (SRI International, Menlo Park, CA (USA)). Feb 1980. 30p. NTIS, PC A03/MF A01.

The theory and programming of statistical tests for evaluating the Real-Time Air-Quality Model (RAM) using the Regional Air Pollution Study (RAPS) data base are fully documented in four report volumes. Moreover, the tests are generally applicable to other model evaluation problems. Volume 1 presents an overview of the tests, displays, software, and application of the resulting statistical package.

14645 **(PB—80-178353) Evaluation of the real-time air-quality model using the RAPS (regional air pollution study) data base. Volume 2. Statistical procedures. Final report August 1977-April 1979.** Javitz, H.S.; Ruff, R.E. (SRI International, Menlo Park, CA (USA)). Feb 1980. 57p. NTIS, PC A04/MF A01.

The theory and programming of statistical tests for evaluating the Real-Time Air-Quality Model (RAM) using the Regional Air Pollution Study (RAPS) data base are fully documented in four volumes. Moreover, the tests are generally applicable to other model evaluation problems. Volume 2 presents the tests considered for evaluating air-quality simulation models in general and those that would be useful in evaluating the RAM. The capability of the RAM to predict sulfur dioxide (SO2) concentrations was of particular interest. Specific tests for both intermediate and final evaluations are recommended, with accompanying descriptions of formats, plots, and procedures to establish confidence limits. Discussion focuses on the mathematics, procedures, and interpretation of the individual tests; their relevance to the project objectives; and possible trade-offs among tests.

14646 **(PB—80-178361) Evaluation of the real-time air-quality model using the RAPS (regional air pollution study) data base. Volume 3. Program user's guide. Final report August 1977-April 1979.** Ruff, R.E.; Shigeishi, H.; Allen, R.H. (SRI International, Menlo Park, CA (USA)). Feb 1980. 141p. NTIS, PC A07/MF A01.

The theory and programming of statistical tests for evaluating the Real-Time Air-Quality Model (RAM) using the Regional Air Pollution Study (RAPS) data base are fully documented in four volumes. Moreover, the tests are generally applicable to other model evaluation problems. Volume 3 presents the software used in the statistical tests for evaluating the RAM. Six statistical tests are described, with attention to the programming philosophy behind them. Also presented is a review of the auxiliary software that sort, retrieve, format, and display the data.

14647 **(PB—80-178379) Evaluation of the real-time air-quality model using the RAPS (regional air pollution study) data base. Volume 4. Evaluation guide. Final report August 1977-April 1979.** Ruff, R.E. (SRI International, Menlo Park, CA (USA)). Feb 1980. 59p. NTIS, PC A04/MF A01.

The theory and programming of statistical tests for evaluating the Real-Time Air-Quality Model (RAM) using the Regional Air Pollution Study (RAPS) data base are fully documented in four volumes. Moreover, the tests are generally applicable to other model evaluation problems. Volume 4 discusses the application and interpretation of the statistical programs, particularly with regard to use on the RAM. In general, there is no set procedure for evaluating an air-quality model because of the different reasons for evaluating models and many subjective decisions to be made during the process. However, guidelines are presented to cover a wide variety of evaluation needs, with attention to data preparation, classification, analysis, selection and application of tests, and interpretation of results. Several methods of diagnosing causes of poor model performance are discussed and some sample program outputs are also provided.

14648 **(PB—80-197361) User's guide for MPTER, a multiple point gaussian dispersion algorithm with optional terrain adjustment.** Pierce, T.E.; Turner, D.B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Apr 1980. 250p. NTIS, PC A11/MF A01.

The information presented in this user's guide is directed to air pollution scientists interested in applying air quality simulation models. MPTER is the designation for Multiple Point source algorithm with TERrain adjustments. This algorithm is useful for estimating air quality concentrations of relatively nonreactive pollutants; hourly estimates are made using the Gaussian steady-state model. The algorithm is most applicable for source-receptor distances less than 10 km and for locations with level or rolling terrain where a single wind vector for each hour adequately approximates the flow over the source and receptor sites. The terrain adjustment option is limited in application to receptors whose elevation is no higher than the lowest stack top elevation of the sources considered. Calculations are performed on the hourly meteorological data that the model requires: wind direction, wind speed, temperature, stability class, and mixing height. Emission information required of the point sources are source coordinates, emission rate, physical height stack diameter, stack gas exit velocity, and stack gas temperature. In addition to terrain adjustment, options are available for stack downwash, gradual plume rise, and buoyancy-induced dispersion. All printed output is optionally available so the user can avoid unneeded output volume. General information is contained in the Executive Summary and the first three chapters. The technical basis for the algorithm is given in Chapter 4 and Appendices A and B. The remaining material herein relates to use and understanding of the computer program for the algorithm.

14649 **(PB—80-808793) Chemiluminescence. 1977-April 1980, 1980 (citations from the International Aerospace Abstracts data base). Report for 1977-April 1980.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 106p. NTIS PC N01/MF N01.

Cited works describe the use of chemiluminescence for aurora and upper-atmosphere analyses, evaluation of chemical laser candidates, studies of jet and combustor dynamics, smog analysis and other work. Sources and forms of chemiluminescence and measurement techniques are described. (Contains 92 citations)

14650 **Comparison of three carbon models.** Gardner, R.H.; Mankin, J.B.; Emanuel, W.R. (Oak Ridge National Lab., TN). *Ecological Modelling ;* **8**: 313-332(1980).

Steady-state values of three global carbon models with randomly varied rate coefficients indicate that: (1) mean values are not strictly comparable between models due to differences in formulations, but importance values determined by canonical analysis indicate that steady-state values are most dependent on the largest pool of carbon in the model; (2) for compartments with high turnover rates, a 10 to 20% coefficient of variation on individual rate flux coefficients can lead to a 250% coefficient of variation on steady-state values; (3) when rate coefficients are varied at 20% of their average value the model predictions range from a 1 in 6 to a 1 in 19 chance that the atmospheric CO_2 concentration will change by as much as a factor of 2. The true values of carbon transfers and the variabilities associated with time and space must be understood if the development and predictions of realistic models are to be reliable.

14651 **Revised motor vehicle exhaust emission standards for carbon monoxide (CO) for 1981 and 1982 model year light-duty vehicles.** *Federal Register (Washington, D.C.) ;* **44**: No. 233, 69416(3 Dec 1979).

This US Environmental Protection Agency final rule establishes several emission standards. Revised standards for 1981 and later model year light-duty vehicles require that emissions of hydrocarbons, CO, and nitrogen oxides (NOx) do not exceed 0.41, 3.4, and 1.0 g/mi, respectively. In the exceptions, CO emissions not to exceed 7.0 g/mi will be required of certain light-duty Toyo Kogyo Co. Ltd. 1981 cars and certain 1981 and 1982 light-duty vehicles

made by American Motors Corp., BL Cars Ltd., Chrysler Corp., General Motors Corp., and Toyota Motor Co., Ltd.; the NOx emissions from these vehicles and certain American Motors Corp. 1981 and 1982 light-duty vehicles should not exceed 2 g/mi. The rule is effective on 12/10/79.

14652 Atmospheric dispersion over water near shoreline environments. Sheih, C.M.; Frenzen, P.; Hart, R.L. (Argonne National Lab., IL). pp 566-571 of Fourth symposium on turbulence, diffusion, and air pollution. Boston, MA; American Meterological Society (1979).

From 4. symposium on turbulence, diffusion, and air pollution; Reno, NV, USA (15 Jan 1979).

Proposals to construct offshore power plants have created a need for improved methods for estimating atmospheric dispersion over water in conditions of onshore air flow. The dispersive properties of the coastal marine atmosphere are unique, not only because the flow is over water (which has been studied far less than has flow over land), but also because in these conditions small-scale dispersion is often combined with large-scale meandering due to sea-breeze or lake-breeze circulations. These two scales of motion must be identified in order to logically synthesize the results of observations.

5002 Chemicals Monitoring And Transport

14653 (AD-A—087853) Criteria for short-term exposures to air pollutants. Final report. (National Research Council, Washington, DC (USA). Advisory Center on Toxicology). Nov 1979. 22p. NTIS, PC A02/MF A01.

The National Research Council's Committee on Toxicology recommends emergency exposure limits (EELs), short-term public limits (STPLs), and short term public emergency limits (SPELs) for a variety of military and space chemicals. This document discusses the factors to be considered in setting limits for predictable and unpredictable short-term exposures to these chemicals. The kinds of information required for setting limits are identified and include data from experimental exposures of humans and animals, general observations on the effects of exposures of individuals, and epidemiologic observations. Other subjects discussed are nuisance effects, effects on vegetation, livestock, and materials, and possible long-term effects of short-term exposures. The process of establishing short-term exposure limits for air pollutants requires experienced judgment in selecting and evaluating the pertinent information. Use of reliable dose-response data from human exposure is the method of choice in selecting exposure limits. These data are rarely available; therefore, animal studies are usually used. Interpretation of the data and the approaches considered by the Committee in translating animal data to establishing exposure limits for humans are discussed. The EELs, STPLs, and SPELs are defined and compared with other exposure limits recommended by various organizations. Some of the judgmental considerations for balancing the risks of short-term exposures are also discussed.

14654 (COO—4319-6) Two-dimensional virtual impactors. Final report. Forney, L.J.; Ravenhall, D.G. (Georgia Inst. of Tech., Atlanta (USA); Illinois Univ., Urbana (USA). Dept. of Physics). Dec 1980. Contract AS02-77EV04319. 132p. NTIS, PC A07/MF A01.

Theoretical predictions using both potential flow analyses and solutions to Navier-Stokes equations are made for the operating characteristics of a two-dimensional virtual impactor. Experiments were performed with 2.5 μm, uranine tagged, di-octylphthalate (DOP) oil droplets for a wide range of prototype geometries to measure the magnitude of internal losses and to fully characterize the instrument response. The influence of geometry including the throat angle ($38^0 \leqq \beta_0 \leqq 58.2^0$) and normalized void width ($0.7 \leqq h/w \leqq 1.5$) on the particle cutoff diameter, efficiency curve steepness and properties of the internal particle loss factor are presented for fixed instrument Reynolds numbers Re = 1540 and bleed flow f = 0.1. The theory, supported by trends in the empirical data, predicts that internal particle losses reduce to zero as the normalized void width increases to h/w = 1.4 +- .1 while the data show a minimum at h/w = 1.6 +- .1. Increasing the void width, however, is shown to substantially reduce the steepness of the particle efficiency curves. Visual observations of the onset of fluid separation for two-dimensional jets impinging upon a void were conducted with a scaled-up water model and correlated with theory. It was found that the limiting void width h/sub lim//w marking the onset of fluid instabilities peaked for an intermediate value of the fluid deflecting plate angle $\beta \simeq 80^0$ with larger values of h/sub lim//w corresponding to smaller throat angles β_0. The limiting void width h/sub lim//w also increased with larger bleed flows into the void. These instabilities may make it difficult to correlate experimental virtual impactor data with theory.

14655 (DOE/EV/03018—T2) Physico-chemical investigation of some areas of fundamental significance to biophysics. Annual report, 1979-1980. McGlynn, S.P. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry). 7 Jul 1980. Contract AS05-76EV03018. 85p. NTIS, PC A05/MF A01.

All projects listed in this report have been submitted for publication as journal articles or DOE reports. Projects include: McGlynn, S.P., Felps, W.S. and Scott, J.D., Molecular Rydberg Transitions. XVIII. Vibronic Doubling in Methyl Iodide; Findley, G.L. and McGlynn, S.P., The Generalized Genetic Code. A Modification of Code Universality; Findley, G.L. and McGlynn, S.P., Fundamental Spectroscopic Studies of Some Atmospheric Pollutants; McGlynn, S.P., Azumi, T. and Kumar, D., The Colors of Post-Transition-Metal Salts; Lewis, J.W., Nauman, R.V., Boulder, D.B., Jr. and McGlynn, S.P., Molecular Rydberg Transitions. XIX. Low-Energy Rydberg States of Azulene; Felps, W.S., Scott, J.D., and McGlynn, S.P., Molecular Rydberg Transitions. XX. Vibronic Doubling in Alkyl Bromides; Felps, W.S. and McGlynn, S.P., Molecular Rydberg Transitions. XXI. Intermediate Coupling in Simple Bromides; McGlynn, S.P. and Felps, W.S., Molecular Rydberg Transitions. XXII. The $\pi \rightarrow 4s$ Transition of ClCN; Chattopadhyay, S., McGlynn, S.P. and Findley, G.L., Photoelectron Spectroscopy of Phosphites, Phosphates and Substituted Phosphates; and Scott, John D., A Perturbed Linear Molecule Model for the Spectroscopy of Almost Linear Molecules. (PSB)

14656 (EPRI-EA—1650-SR) Regional air-quality studies: the needs and the priorities. Hilst, G.R. (Electric Power Research Inst., Palo Alto, CA (USA)). Feb 1981. 70p. NTIS, PC A04/MF A01.

The rationale for a priority structuring of EPRI's Regional Air Quality Studies (RAQS) is provided and translated into a five-year research plan. Four topical research problems are addressed. They are SO/sub x//NO/sub x/ chemistry, acidic precipitation, trace elements and fine particles, and visibility. The analysis and planning includes an identification of research needs common to all four areas as well as specialized research requirements. The plan also addresses the desirability of coordinating EPRI's RAQS projects with complementary research funded by other agencies. The results of this analysis and planning exercise take the form of a comprehensive examination of the research required to meet the electric utility industry's needs, and a priority ordering of this research during the next five years. A major conclusion is that the large regional measurements projects that have characterized EPRI's RAQS projects to date should be gradually diminished (but not eliminated) in favor of a more nearly balanced program of theoretical, laboratory, and analytical efforts.

14657 Improvement of mathematical models for plume rise and drift deposition from cooling towers. Policastro, A.J.; Carhart, R.A.; Wastag, M.; Ziemer, S.; Haake, K. (Argonne National Lab., IL (USA)); Dunn, W.E.; Gavin, P. (Illinois Univ., Urbana (USA)). pp 43-48 of Atmospheric pollution, 1980. Benarie (ed.). Amsterdam, Netherlands; Elsevier Scientific (1980).

From 14. international symposium on atmospheric pollution; Paris, France (5 May 1980).

New models for plume rise and salt-drift deposition from cooling towers and presented. For plume rise, assumptions are made which help resolve the usual difficulty of correclty predicting both plume trajectory and dilution. The multiple-tower plume merging method accounts for different rates of entrainment depending on the orientation of the merging plumes with the wind direction. Model calibration and verification have been made with field and laboratory data from natural- and mechanical-draft cooling

towers. For salt-drift deposition modeling, new droplet breakaway and droplet evaporation formulations are developed. The drop evaporation treatment accounts for the usually important effects of droplet salt-concentration gradients. The drift model has been validated with field data taken at the Chalk Point site.

14658 **(PB—80-171226) Gasohol test program. Technical report.** Lawrence, R. (Environmental Protection Agency, Ann Arbor, MI (USA)). Feb 1980. 37p. NTIS, PC A03/MF A01.

A request for a waiver to permit use of ten percent Ethanol in gasoline ('gasohol') was considered by EPA-Mobile Source Enforcement Division (MSED). The Emission Control Technology Division (ECTD) in Ann Arbor, Michigan was requested to assist MSED by testing ten vehicles on two gasoline fuels and three gasohol fuels. In addition, ECTD directed Southwest Research Institute (a contractor laboratory) to test three vehicles on the five fuels plus other fuels containing methyl tertiary butyl ether (MTBE) and teritary butyl alcohol (TBA), other fuel additives for which waivers have been requested. EPA-ORD was requested to provide more extensive emission data on two test vehicles. Since the completion of the ECTD test program described in this report, EPA has acted to allow the use of ten percent ethanol in gasoline. Future control of this or other fuel additives is authorized under Section 211 of the 1977 Amendments to the Clean Air Act.

14659 **(PB—80-173891) A suggested experimental plan for the determination of the accuracy and reliability of coal mine dust measurements. Final report 1 February 1977-June 1979.** Ku, H.H.; Rosenblatt, J.R. (National Bureau of Standards, Washington, DC (USA)). Oct 1979. 48p. NTIS, PC A03/MF A01.

The work in this study was done under an agreement with the National Bureau of Standards and the Bureau of Mines with the objective to determine the accuracy and reliability of dust measurements when taken with the current equipment by coal miners in underground mines. The work is to be conducted in two phases. The first is to develop an experimental plan to determine the accuracy and reliability of coal mine dust measurements at three levels of funding and will serve as a basis for the second phase in which the experimental work will be conducted.

14660 **(PB—80-181084) Modeling of simulated photochemical smog with kinetic mechanisms. Volume 2. Chemk: a computer modeling scheme for chemical kinetics. Final report, July 1978-September 1979.** Whitten, G.Z.; Hogo, H. (Systems Applications, Inc., San Rafael, CA (USA)). Feb 1980. 115p. NTIS, PC A06/MF A01.

Mechanisms that describe the formation of photochemical smog are developed using a computer modeling technique directed toward the simulation of data collected in two smog chambers: an indoor chamber and a dual outdoor chamber. Individual compounds for which specific experiments were simulated and mechanisms developed include the following: formaldehyde, acetaldehyde, ethylene, propylene, butane, and toluene. Volume 2 contains the user's manual and coding for a chemical kinetics computer program, CHEMK.

14661 **(PB—80-181910) Total particulate mass emission sampling errors. Final report, November 1976-April 1977.** Brooks, E.F. (TRW Systems and Energy Group, Redondo Beach, CA (USA)). Jul 1979. 52p. NTIS, PC A04/MF A01.

The report gives a first-cut estimate of sampling errors in the measurement of total particulate mass emissions from stationary sources. IERL-RTP Procedures Manual: Level 1 Environmental Assessment expresses the desire to measure at accuracies within a factor of + or - 2 to 3. Measurement errors are divided into two general categories: sampling errors and analysis errors. The report deals with evaluation of total particulate mass sampling errors, within the framework of a system error analysis. The evaluation leads to a ranking of individual error sources and estimates of total system error. Analysis results show that a Level 1 should have a sampling accuracy of better than a factor of + or - 2, with a confidence of 95%, except at a control device outlet where the accuracy is more likely to be a factor of + or - 3, especially if the control device is an electrostatic precipitator.

14662 **(PB—80-181936) An evaluation study of EPA Method 8. Final report.** Knoll, J.E.; Midgett, M.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). Mar 1980. 44p. NTIS, PC A03/MF A01.

Techniques used in EPA Method 8, the source test method for acid mist and sulfur dioxide emissions from sulfuric acid plants, have been evaluated. Evidence is shown that trace amounts of peroxides in isopropyl alcohol result in the conversion of sulfur dioxide to sulfate and cause positive errors in acid mist values. Methods for measuring and purifying IPA are described. No conversion of sulfur dioxide to sulfate on filters or filter supports were observed. Collection efficiencies of train components are described and two alternate indicators are evaluated. Solid ammonium sulfates's use as audit samples is discussed. Field testing is also described in which paired-probe techniques were employed. They showed that, when sulfur trioxide is absent from the effluent streams, acid mist is efficiently collected by a single filter, even when the isopropyl alcohol-containing impinger is eliminated. Both ammonia and dimethyl analine, which are employed as gas scrubbers, cause sulfur dioxide to be retained in the isopropyl alcohol and result in large positive interferences in acid mist values. Ferric oxide, present in the effluents of steel pickling operations, causes a large negative interference in acid mist values.

14663 **(PB—80-182363) Experience with indirect source controls in the United States: four case studies. Final report.** Harvey, G.; Rappaport, A.; Deakin, E. (Cambridge Systematics, Inc., MA (USA)). Dec 1978. 166p. NTIS, PC A08/MF A01.

This report presents a review of experience with highway air quality assessments in four case study areas: New York State; Connecticut; Puget Sound (Seattle/Tacoma), Washington; and Oregon. Four case studies document the procedures used by federal, state and local governments: (1) To identify the need for an assessment of the air quality effects of a proposed highway project; (2) To determine the appropriate level of analysis when an assessment is required; (3) To provide for review of the air quality assessment by agencies and the public; (4) To resolve differences over technical and policy issues and arrive at a decision. The studies show a wide range of approaches to highway air quality review, with significant differences in aspects such as: (1) Relationships among indirect source review and other state and federal air quality reviews; (2) Number and size of highway facilities to which indirect source review applies; (3) Threshold levels for applicability of indirect source review to new or modified highways; (4) Pollutants covered.

14664 **(PB—80-184526) The direct use of coal. Volume II-part B: working papers. Appendices VII thru IX.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Dec 1979. 607p. NTIS, PC A99/MF A01.

The contents include: (1) Environmental considerations for increased coal utilization; (2) Transport and fate of sulfur and other air pollutions; (3) Prediction and review of air pollution health effects from direct coal combustion.

14665 **(PB—80-185549) Effective sampling techniques for particulate emissions from atypical stationary sources. Final report Feb 77-Jan 79.** Saari, D.P.; Hanson, H.A. (FluiDyne Engineering Corp., Minneapolis, MN (USA)). Jan 1980. Contract EPA-68-02-1796. 200p. NTIS, PC A09/MF A01.

Sampling techniques for measuring particulate emissions from four 'atypical' stationary source categories were developed and evaluated. The categories include low effluent velocity streams, extended dimensions, partially or totally unconfined flow, and saturated gas streams or gas streams with entrained liquid droplets. Research included literature surveys, laboratory model testing, and field testing of instruments and techniques on three specific sources -- gravity roof ventilators, grain dryers, and wet scrubbers. These three sources served as representative examples of the four atypical source categories. The sampling techniques recommended for roof ventilator emission measurements include a high volume particulate sampler and a heated thermopile anemometer deployed near the base of the ventilator. The same instruments, deployed at the lower exhaust, are recommended for grain dryer emission measurements.

An EPA Method 5 type sampling train, an inertial droplet separator, and a Fecheimer probe are recommended for use in wet scrubber emission measurements.

14666 **(PB—80-187420) Review of concurrent mass emission and opacity measurements for coal-burning utility and industrial boilers. Final report Aug 79-Feb 80.** Brennan, R.J.; Dennis, R.; Roeck, D.R. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Mar 1980. Contract EPA-68-02-2607. 100p. NTIS, PC A05/MF A01.

The report gives results of concurrent particulate emissions and opacity measurements based on visual observations and/or in-stack transmissometry for more than 400 compliance, acceptance, or experimental tests on coal-fired utility and industrial boilers. The sampling, which includes a capacity range of a few to several hundred megawatts and typical firing methods (pulverized, stoker, and cyclone), in most cases reflects flyash control by electrostatic precipitation, although filters or mechanical collectors were used at a few installations. All opacity measurements were standardized to their equivalent values for a 4 m (13.0 ft) diameter stack before being compared with their corresponding particulate emissions, the latter expressed as actual grams per cubic meter. No discernible correlations applicable to all sources were observed, although some modest (but apparently significant) correlations were noted on an individual source basis. Report findings were sufficiently encouraging to warrant further analyses relating to in-stack transmissometer measurements.

14667 **(PB—80-187438) Charge measurements of particles exiting electrostatic precipitators. Final report Oct 78-Oct 79.** McDonald, J.R.; Anderson, M.H.; Mosley, R.B. (Southern Research Inst., Birmingham, AL (USA)). Apr 1980. Contract EPA-68-02-2610. 59p. NTIS, PC A04/MF A01.

The report gives results of an investigation of particle charging in positive and negative corona discharge as a function of temperature from 38 to 343C in order to establish, especially at hot-side electrostatic precipitator (ESP) temperatures, the relative effectiveness of the two possible methods of charging. Charge values on individual particles exiting two laboratory ESPs were measured in an experimental apparatus utilizing a Millikan cell. Measurements were directed at fine particles with radii between 0.3 and 1.5 micrometers. Measurements were obtained for redispersed fly ash particles carried in air at temperatures from 38 to 343C. The electrode geometries and electrical operating conditions utilized were typical of full-scale ESPs.

14668 **(PB—80-187446) Regulated and unregulated exhaust emissions from a malfunctioning three-way catalyst gasoline automobile. Final report Aug 78-Nov 79.** Urban, C.M. (Southwest Research Inst., San Antonio, TX (USA)). Jan 1980. Contract EPA-68-03-2692. 171p. NTIS, PC A08/MF A01.

This report describes the laboratory effort to characterize regulated and unregulated exhaust emissions from a current model three-way catalyst-equipped gasoline automobile operating under malfunction conditions. One automobile was evaluated over three driving schedules in the unmodified configuration and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include: particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of the regulated emissions over four short-test procedures.

14669 **(PB—80-187453) Study of exhaust emissions from 1978-1980 model year three way catalyst vehicles in Los Angeles. Final report.** Moore, L.L.; Jones, A.D. (Automotive Environmental Systems, Inc., Westminster, CA (USA)). Mar 1980. Contract EPA-68-03-2889. 269p. NTIS, PC A12/MF A01.

This report presents and summarizes exhaust emission data and other information obtained as a result of the testing and inspection of 350 in-use passenger cars. The test fleet was made up of 1978, 1979 and 1980 automobiles manufactured by Ford, General Motors, Mazda, Saab, Toyota, Volkswagen/Audi and Volvo. Each vehicle was equipped with a three way catalyst control system. They were obtained randomly from private owners in the Los Angeles and Orange County areas. The testing was completed December, 1979. Each vehicle was tested only in as-received condition. The test sequence consisted of the 1975 Federal Test Procedure (exhaust emissions only), a Highway Fuel Economy test, a Two-Speed Idle test, a Federal Three Mode test, and a Loaded Two Mode test. After the initial test sequence, each vehicle was subjected to a thorough underhood inspection.

14670 **(PB—80-187735) Environmental assessment of a coal-fired controlled utility boiler. Final report Jun 78-Dec 79.** Leavitt, C.; Arledge, K.; Shik, C.; Orsini, R.; Saur, A. (TRW, Inc., Redondo Beach, CA (USA)). Apr 1980. Contract EPA-68-02-2613. 236p. NTIS, PC A11/MF A01.

The report gives results of a comprehensive multimedia emissions assessment of the cyclone-fired La Cygne No. 1 boiler, equipped with SO2 and particulate emission controls. Levels 1 and 2 procedures were used to characterize pollutant emissions in gaseous, liquid, and solid process streams. Assessment results, in conjunction with assumed typical and worst case meteorological conditions, were used to estimate the environmental impact of emissions from this type of unit.

14671 **(PB—80-188840) APTI (Air Pollution Training Institute) course 450: source sampling for particulate pollutants, instructor's guide.** Aldina, G.J.; Jahnke, J.A.; Henry, J. (Northrop Services, Inc., Research Triangle Park, NC (USA)). Feb 1980. Contract EPA-68-02-2374. 225p. NTIS, PC A10/MF A01.

The Instructor's Guide for Air Pollution Training Institute Course 450 'Source Sampling for Particulate Pollutants' contains guidelines for conducting a four and one-half day course in source sampling. The Guide contains lesson plans, laboratory instructions, exams, copies of handout materials, and solutions to problem sets. The lesson plans include keys to APTI audio visual materials and suggested instructional techniques. These materials are intended for use in conjunction with Student Manual PB80-174360 and Student Workbook EPA 450/2-79-007.

14672 **(PB—80-190473) Regulated and unregulated exhaust emissions from malfunctioning non-catalyst and oxidation catalyst gasoline automobiles. Final report Dec 76-Apr 79.** Urban, C.M. (Southwest Research Inst., San Antonio, TX (USA)). Jan 1980. Contract EPA-68-03-2499. 308p. NTIS, PC A14/MF A01.

This report describes the laboratory effort to characterize regulated and unregulated exhaust emissions from non-catalyst and oxidation catalyst-equipped gasoline automobiles operating under malfunction conditions. One non-catalyst and four catalyst-equipped automobiles were evaluated over three driving schedules in the unmodified and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include particulates, sulfates, aldehydes, sulfides, amines, metals and several additional elements and compounds.

14673 **(PB—80-190804) Regulated and unregulated exhaust emissions from malfunctioning three-way catalyst gasoline automobiles. Final report Aug 77-Sep 79.** Urban, C.M. (Southwest Research Inst., San Antonio, TX (USA)). Jan 1980. Contract EPA-68-03-2588. 241p. NTIS, PC A11/MF A01.

This report describes the laboratory effort to characterize regulated and unregulated exhaust emissions from three-way catalyst-equipped gasoline automobiles operating under malfunction conditions. Three automobiles were evaluated over three driving schedules in the unmodified configuration and in four engine and/or emission control system malfunction configurations. Exhaust emission constituents measured, in addition to the currently regulated emissions, include: particulate, sulfates, aldehydes, sulfides, amines, metals, and several additional elements and compounds. Additional evaluations, in each of the configurations, involved the measurement of regulated emissions over four short-cycle procedures.

14674 **(PB—80-191869) Performance of simple models for stack plume dispersion during convective conditions. Final report.** Weil, J.C. (Martin Marietta Corp., Baltimore, MD (USA). Environmental Center). Apr 1980. 45p. NTIS, PC A03/MF A01.

This report presents tests of two simple approaches for predicting ground-level concentrations during unstable conditions – the Gaussian plume and the Venkatram models. The Gaussian model was chosen because of its widespread use and the controversy surrounding the choice of dispersion parameters used in it. The Pasquill-Gifford A and B stability classes and the Brookhaven National Laboratory B2 Class were tested. The Venkatram model is based on recent theoretical ideas concerning the structure of the convectively mixed layer and dispersion of pollutants within it.

14675 **(PB—80-192446) Evaluation of the Hoboken converter at Glogow, Poland. Report for Jan 76-Feb 79.** Smieszek, Z. (Instytut Metali Niezelaznych, Gliwice (Poland)). Apr 1980. 148p. NTIS, PC A07/MF A01.

In 1975, the U.S. Environmental Protection Agency awarded a contract to the Ministry of Smelting Poland for research to minimize emissions of fugitive pollutants from copper smelters and to assist in the control of smelter pollutants. The project objectives were to develop procedures for operating copper converters for steady gas flow containing relatively high concentrations of SO2; to improve cleaning and treating of particulates in the converter gas streams to allow better operation of SO2 removal systems, such as contact sulfuric acid plants; and to show how procedures and results that were developed could be applied to various types of copper smelters encountered in industry. During the course of the project, portions of the PL-480 funding were utilized to evaluate the Hoboken Converter, a potential substitute process providing stricter environmental control of fugitive SO2 and particulate from copper converting.

14676 **(PB—80-192495) Application of photochemical models. Volume I. Use of photochemical models in urban ozone studies. Final report.** Wada, R.Y.; Wong, M.J.; Leong, E.Y.; Robinson, L.H.; DeMandel, R.E. (Association of Bay Area Governments, Berkeley, CA (USA)). Dec 1979. Contract EPA-68-02-3046. 167p. NTIS, PC A08/MF A01.

This document describes procedures for application of photochemical models in the development of State Implementation Plans. Based largely on recent experience gained in photochemical model applications in the San Francisco Bay Area and in Denver, the guidance is directed toward potential model users in other ozone non-attainment areas. The guidance covers the following tasks: model selection; data collection and model input preparation including meteorological and topographical data, emission inventory data, ambient air quality data, treatment of initial and boundary conditions, and special field studies; the evaluation of photochemical model performance; model applications; and interpretation of model results with respect to attainment of the Federal ozone standard.

14677 **(PB—80-192602) Assessment of control technology for stationary sources. Volume I: technical discussion. Final report.** Minicucci, D.; Herther, M.; Babb, L.; Kuby, W. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Feb 1980. Contract ARB-A7-170-30. 198p. NTIS, PC A09/MF A01.

The purpose of this project was to develop a reference document for use by the Air Resources Board, local air pollution control districts, and the U.S. Environmental Protection Agency that describes technological options available for the control of emissions from stationary sources located in California. Control technologies were examined for 10 industry groups and six air pollutants. Volume I, Technical Discussion, includes an overall introduction to the project, descriptions of its major elements, background information for each industry group addressed, and the project bibliography. In Volume II, Control Technology Data Tables, qualitative descriptions of control options for the various sources and quantitative information on control technology cost, efficiency, reliability, energy consumption, other environmental impacts, and application status are presented in tabular format. Also included is a code list that classifies the stationary sources examined by industry, process and emission source.

14678 **(PB—80-192610) Assessment of control technology for stationary sources. Volume II: control technology data tables. Final report.** Minicucci, D.; Herther, M.; Babb, L.; Kuby, W. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Feb 1980. Contract ARB-A7-170-30. 738p. NTIS, PC A99/MF A01.

This report, the Control Technology Data Tables, is the second volume of the three-volume final report for the contract. It presents in tabular format, qualitative descriptions of control options for the various sources and quantitative information on control technology cost, efficiency, reliability, energy consumption, other environmental impacts and application status. Also included is a code list which classifies the stationary sources examined by industry, process, and emission source.

14679 **(PB—80-192743) Summary of group II control technique guideline documents for control of volatile organic emissions from existing stationary sources. Final report.** Capone, S.V.; Petroccia, M. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Feb 1980. Contract EPA-68-02-2607. 36p. NTIS, PC A03/MF A01.

Control Technique Guideline (CTG) documents have been prepared by the Office of Air Quality Planning and Standards of the U.S. EPA to assist states in defining reasonably available control technology (RACT) for the control of volatile organic compound emissions from existing stationary sources. A document (PB-294 975) summarizing the CTG documents issued prior to January 1978 (Group I) was published in December 1978. This document (PB80-192743) summarizes the CTG documents issued between January 1978 and January 1979 (Group II). A description of each source category is provided, along with RACT and costs to retrofit a model facility. The source categories included are: leaks from petroleum refinery equipment, surface coating of miscellaneous metal parts and products, manufacture of vegetable oil, surface coating of flat wood paneling, synthesized pharmaceutical products manufacturing, pneumatic rubber tire manufacturing, graphic arts (rotogravure and flexography), external floating roof tanks, perchloroethylene dry cleaning, and leaks from gasoline tank trucks and vapor collection systems.

14680 **(PB—80-193147) TI-59 programmable calculator programs for in-stack opacity, venturi scrubbers, and electrostatic precipitators. User manual Jul 78-Jul 79.** Cowen, S.J.; Ensor, D.S.; Sparks, L.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). May 1980. 165p. NTIS, PC A08/MF A01.

The report explains the basic concepts of in-stack opacity as measured by in-stack opacity monitors. Also included are calculator programs that model the performance of venturi scrubbers and electrostatic precipitators. The effect of particulate control devices on in-stack opacity can be predicted by using these programs. The size distribution data input can be either in lognormal or histogram format. The opacity is calculated using Deirmendjian's approximation to Mie series to obtain extinction efficiencies. An alternative opacity program employing the exact Mie series solution is also described. The running time for this program is about 8 hours; that for the approximation program is 30 minutes. The accuracy of these programs is as good as the measured data input.

14681 **(PB—80-193279) Development of air sampling and analytical methods for toxic chlorinated organic compounds. Research report for hexachlorocyclopentadiene.** Dillon, H.K. (Southern Research Inst., Birmingham, AL (USA)). Feb 1980. Contract PHS-NIOSH-210-78-0012. 84p. NTIS, PC A05/MF A01.

This report describes the development of a sampling and analytical method for the determination of hexachlorocyclopentadiene in air. The developed method is based on the collection of the compound from air with a solid sorbent, Porapak T; desorption of the compound with hexane; and the analysis of the extract by gas chromatography with electron capture detection. The overall method was evaluated in the concentration range of about 13 to 865 microgram/cu m in 3-L air samples. The average bias from an independent analytical method was +1%; the pooled relative standard deviation was 8%.

14682 **(PB—80-193360) Evaluation of a commercial vacuum system for the removal of asbestos. Final report, October-December 1979.** Welker, R.W.; Finn, D.F.; Stockham, J.D.; Hancock, R.P. (IIT Research Inst., Chicago, IL (USA)). May 1980. Contract EPA-68-02-2617. 84p. NTIS, PC A05/MF A01.

The report gives results of a brief field study that included measurement of personal, area, and environmental asbestos exposures resulting from wet and dry asbestos removal using a commercial vacuum system. Personal and area (indoor) asbestos concentrations during dry removal were less than 1 fiber/cu cm, as measured by NIOSH P and CAM 239 when the vacuum system was used. Asbestos released to the environment from the vacuum system's three-stage exhaust filter was negligible. Asbestos was released from the operator's protective garments when he exited the work area to service the vacuum system. Sources of asbestos fiber release associated with vacuum system operation were identified; these occurred during operation, disassembly, and asbestos disposal. Following vacuum shutdown, liquid drained from the collection reservoir due to inadequate door seals. During vacuum hose disassembly, bulk losses of asbestos-containing materials occurred. During disposal, the exterior of the vacuum truck became contaminated as the reservoir was emptied. Additional dry removal testing is required.

14683 **(PB—80-193436) Source category survey: animal feed defluorination industry. Final report.** Hoover, J.R.; Meling, J.L. (Radian Corp., Durham, NC (USA)). May 1980. Contract EPA-68-02-3058. 42p. NTIS, PC A03/MF A01.

This study investigated the need for new source performance standards (NSPS) for processes that defluorinate phosphate rock to produce an animal feed supplement. This defluorination is accomplished by heating phosphate rock in a kiln or fluidized bed to about 1370C to drive off fluoride as HF. It is recommended that NSPS not be developed. The only three domestic plants, all in Florida, have a very small growth potential. Any expansion within the next five years would probably be a single kiln or fluid bed furnace added to existing facilities at one of these plants. The total combined fluoride emissions are only 27 tons/year for the three plants. The best demonstrated control technology (a fabric filter or a wet scrubber) is already used at each plant, and the Florida State regulations will continue to make this type of control a practical necessity.

14684 **(PB—80-193709) Assessment of H_2S control technologies for geothermal power plants. Consultant report (final).** (Acurex Corp., Mountain View, CA (USA)). Feb 1980. 123p. NTIS, PC A06/MF A01.

This report analyzes techniques for controlling Hydrogen Sulfide (H2S) from geothermal development. H2S, a malodorous, toxic gas is emitted from power plant and well field operations. Several technologies for controlling H2S emissions from power plants are examined. The Hydrogen Peroxide Combination System, Stretford System and possibly EIC or Coury upstream controls appear capable of compliance with the emission limitations of 100 grams per hour per gross megawatt in 1980 (and 50 q/hr/(g) MW in 1985 or 1990) at the Geysers Dry stream field in Northern California. Potential controls for stacking are: (1) upstream abatement, (2) automated well operation, (3) computerized well-field operation (as of PGandE's Geysers Unit No. 15) and (4) further steamfield interconnection (cross-overs). H2S controls for liquid geothermal resources are largely in developmental or theoretical stages and greater efforts are needed to insure resource development with minimal environmental consequences.

14685 **(PB—80-194962) Aerosol source characterization study in St. Louis, trace element analysis.** Hardy, K.A. (Florida International Univ., Miami (USA). Dept. of Physical Sciences). Feb 1980. Contract EPA-68-02-2406. 199p. NTIS PC MF A01.

The aerosol in St. Louis was sampled in July 1975 to better characterize the aerosol in an urban environment with moderate dispersion characteristics and heavy industrial activity. Two sampling sites were chosen, one in downtown St. Louis and a second close to the industrialized section in south St. Louis. Aerosol source coefficients show that the aerosol from the downtown site is primarily from coal (60-80%), cement dust (17%), steel manufacturing (6-7%) and auto emissions (3%). The aerosol from the industrialized site is primarily due to coal combustion products and dust (75%), and cement dust (15%), while auto emissions and heavy industrial processes account for about 5% of the aerosol mass. Determining the directional distribution of the aerosol trace elements allowed pinpointing of strong local sources.

14686 **(PB—80-195050) Trace metal deposition on agricultural crops near the Chalk Point Generating Station. Master's thesis.** Mastradone, P.J. (Maryland Univ., College Park (USA). Water Resources Research Center). Nov 1979. 178p. NTIS, PC A09/MF A01.

The objectives of this investigation were (1) to determine the effects of major technological changes in electric power generation on the release of heavy metals into the environment (2) to examine the distribution and deposition of several heavy metals in the agricultural environment near Chalk Point and (3) to determine the effects of the deposition on the concentrations of these metals associated with corn (Zea mays) and soybeans (Glycine max) grown in the region.

14687 **(PB—80-195332) Development of a quantitative air sampling and analytical method for diethylcarbamoyl chloride. Research report 1978-79.** Glaser, R.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). 1980. 23p. NTIS, PC A02/MF A01.

The air sampling and analytical method for diethylcarbamoyl chloride (DECC) involves collection of the analyte on Porapak P, a styrene-divinylbenzene porous polymer. The samples are desorbed with ethyl acetate and the resulting solution is analyzed by gas chromatography using a flame ionization detector. The method has been validated over the range of 40 - 1250 microgram/sample.

14688 **(PB—80-195407) Management of air quality in and near highway tunnels. Executive summary. Final report, June 1974-April 1979.** Schlaug, R.N. (Science Applications, Inc., La Jolla, CA (USA)). Jan 1980. Contract DOT-FH-11-8538. 53p. NTIS, PC A04/MF A01.

A comprehensive study was made of air quality management (AQM) practices applicable to highway tunnels for the purpose of improving the design and operation of tunnel ventilation systems. The study consisted of a review and analysis of current AQM practices, a field program in which air flow and air quality measurements were made in operating tunnels, theoretical analysis of the factors affecting tunnel air quality, the development of computer models of AQM systems, and use of the computer models to investigate alternate ventilation methods and to formulate AQM guidelines.

14689 **(PB—80-195597) Interdisciplinary investigation of environmental pollution by lead and other heavy metals from industrial development in the new lead belt of southeastern Missouri. Volume I. Progress report (interim) May 1972-June 1974.** Bolter, E.; Gale, N.L.; Hardie, M.G.; Hemphill, D.D.; Jennett, J.C. (Missouri Univ., Rolla (USA)). Jun 1974. 484p. NTIS, PC A21/MF A01.

This report describes a project that has developed research information, cooperation between industries and agencies, and applications of technology to control trace contaminants associated with lead production in southeast Missouri. This area is the largest lead producing district in the world; consequently, this study provides significant information on the magnitude, distribution, and impact of lead on the environment at the source of mining, milling, and smelting. The report presents data on air quality, heavy metal transport from fugitive sources, the efficiency of various smelter emission control devices, soil and geochemical studies, the relationship between humic acids and heavy metals, water quality, the cheap and effective meander treatment system for mini-mill waste, aquatic biology studies, accidents produced by smelters, vegetation, remote sensing techniques for detecting environmental problems, techniques for automated land use mapping, analytical facilities, storage and analysis techniques, and research experiments in the

translocation of lead. A large portion of the report is illustrated with graphs, charts, and diagrams.

14690 **(PB—80-195662) Water and air quality control with a coil type filter. Technical report.** Wang, L.K.; Magee, R.S.; Tang, Y. (Stevens Inst. of Tech., Hoboken, NJ (USA). Dept. of Mechanical Engineering). 15 Feb 1980. 62p. NTIS, PC A04/MF A01.

A coil type filter has been developed and experimentally evaluated for environmental control. The filter comprises a spiral wound coil having an inlet and an outlet at opposite ends. The inlet and outlet apertures have screens positioned to retain the filtering element within the coil. Couplings are provided on the exterior of the coil at each end for connection to other portions of a fluid flow system. The interior of the coil is filled with adsorbents, absorbents, ion exchange resins, and filter media which perform the purifying operation. The spiral wound coil may be mounted within a housing with the inlet and outlet both extending outwardly from the same portion of the housing. A thermostatically controlled heating element may be mounted within the housing to control the temperature of the fluid within the coil. It has been proven experimentally that the newly developed coil type filter can adequately remove toxic organics and heavy metals from water. Other potential applications in air quality control and resources recovery, and possible regeneration procedures are proposed and discussed.

14691 **(PB—80-195753) Fine particle emissions information system. Annual report, January-December 1979.** Reider, J.P.; Hegarty, R.F. (Midwest Research Inst., Kansas City, MO (USA)). May 1980. Contract EPA-68-02-2641. 67p. NTIS, PC A04/MF A01.

The report is the second annual report on the Fine Particle Emissions Information System (FPEIS), a computerized data base on primary fine particle emissions from stationary sources. The report summarizes new data added to the FPEIS during 1979 and outlines objectives for 1980 including the emergence of the Environmental Assessment Data Systems (EADS). The FPEIS provides a centralized inventory of fine particle measurement information for researchers engaged in fine particle control technology development and in the environmental assessment of energy and industrial processes. The first (1978) annual report on FPEIS reported 120 test sites in the data base. By the end of 1979, 47 new test sites had been added to the data base and the total of sampling runs had increased to over 2800.

14692 **(PB—80-196843) Wood residue-fired steam generator particulate matter control technology assessment.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Oct 1978. 25p. NTIS, PC A02/MF A01.

This document presents the results of a performance review of particulate matter control systems on wood-fired steam generators. This review describes the industry, presents the characteristics of wood residue and particulate emissions, and discusses the control equipment and emission limits which represent Best Available Control Technology (BACT).

14693 **(PB—80-197106) Comparison between predictions of two Gaussian models (CRSTER and modified CRSTER) and measured SO_2 concentrations near tall stacks under convective conditions. Final report.** Brower, R. (Martin Marietta Corp., Baltimore, MD (USA)). Jul 1980. 17p. NTIS, PC A02/MF A01.

The ability of two Gaussian plume models (CRSTER and modified CRSTER) to predict ground-level concentrations are compared. The modified model is found to be much more accurate in convective conditions, particularly because of a plume penetration feature.

14694 **(PB—80-197544) Control techniques for lead air emissions. Volume I: Chapters 1-3. Final report.** Augenstein, D.M.; Corwin, T.; Hearn, R.; Katari, V.; Sperber, J. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Dec 1977. Contract EPA-68-02-1375. 214p. NTIS, PC A10/MF A01.

This report documents atmospheric emissions of lead (Pb) and its compounds from various sources, methods for controlling these emissions, and approximate costs for implementing these control methods. Estimates of energy and environmental impacts are given for specific model plants.

14695 **(PB—80-197551) Control techniques for lead air emissions. Volume II: Chapter 4 - Appendix B. Final report.** Augenstein, D.M.; Corwin, T.; Hearn, R.; Katari, V.; Sperber, J. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Dec 1977. Contract EPA-68-02-1375. 370p. NTIS, PC A16/MF A01.

This publication describes sources of atmospheric lead (Pb) emissions in the United States and deals with methods of emission control and estimated costs of controls. Lead emissions have been almost ubiquitous in this country and have arisen from automobiles, the metallurgical industry, fuel combustion, and many lead-using manufacturing processes. Gasoline combustion contributed 90.4 percent of the 141.4 Gg (155,900 tons) total lead emissions in 1975. The next largest lead emitters were waste oil disposal, primary copper smelting, and solid waste incineration. Significant sources of fugitive lead emissions are primary nonferrous smelters and secondary lead smelters. Lead emissions from gasoline have consisted mostly of lead oxides; lead alkyl manufacture emits small amounts of those alkyls as vapors. Control of lead emissions from automobiles is being achieved by reduction or elimination of lead in gasoline. Particulate lead emissions from industry are being controlled by electrostatic precipitators and fabric filters, up to efficiencies of about 99.5 and 99.9 percent, respectively. Scrubber efficiencies can reach 99 percent at the expense of high power usage. Cost data on lead emission controls is limited; therefore, for most industrial sources, model plants were described, and equations were derived for capital and annualized costs, based on exhaust flow rate and annual labor hours. Appendix B of the document shows how the equations may be adjusted to apply to either new or retrofit construction.

14696 **(PB—80-198062) Impacts of airborne pollutants on wilderness areas along the Minnesota-Ontario border.** Glass, G.E.; Loucks, O.L. (Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.). May 1980. 201p. NTIS, PC A10/MF A01.

The goal of this study was to examine previously unanswered questions concerning potential effects of the proposed Atikokan, Ontario power plant on ecosystems in the Boundary Waters Canoe Area Wilderness (BWCA) and Voyageurs National Park (VNP) of Minnesota by using the most relevant data and analytical methods. The principal steps were to focus on: (1) the ultimate deposition of emissions from the plant (rather than only on pollutant concentrations), (2) the use of a time-varying grid model with provision for atmospheric transformations, and (3) a detailed review of all available data from the region on atmospheric deposition of pollutants, water quality, and effects. The results are considered in relation to a review of responses by terrestrial and aquatic organisms to changes in the chemistry of this environment.

14697 **(PB—80-198252) ACT (Available Control Technology) for stationary NOx sources. Final report.** Mueller, R.; Lips, H.; Castaldini, C.; Davis, K.; Herther, M. (Acurex Corp., Mountain View, CA (USA)). Dec 1979. Contract EPA-68-01-4142. 150p. NTIS, PC A07/MF A01.

Engineering evaluations of stationary source NOx controls were conducted and are reported here to support EPA Region IX in determining whether the NOx emission control rules in the EPA approved State Implementation Plan (SIP) and the recently submitted SIP revisions for the Los Angeles and San Diego areas represent an adequate level of NOx emission control for stationary sources. This report documents the following: A summary of the stationary source NOx emission control rules contained in the SIPs; 'Available Control Technology (ACT)' specifications for NOx sources in these areas; and a summary of NOx rules for other areas in the U.S. The ACT specification includes estimates of baseline and controlled emissions levels, the limitations and operational impacts, and the control costs associated with ACT. Sources considered include utility and industrial boilers, gas turbines, internal combustion engines, and industrial processes. Control technologies

include several levels of combustion modifications and post combustion cleanup.

14698 (PB—80-198443) Flue gas desulphurization. Bosma, R. (Netherlands Energy Research Foundation, Petten). May 1979. 81p. NTIS, PC A05/MF A01.

The NATO Committee on the Challenges of Modern Society (CCMS) performed a study on existing Flue Gas Desulphurization Processes. In addition to a description of the processes itself data have been collected on cost, efficiency, availability, energy losses and applicability. The results have been published in twelve technical reports on the following processes: limestone/sludge, lime/sludge, double alkali/sludge, seawater scrubbing, limestone/gypsum, lime/gypsum, double alkali/gypsum, dilute sulfuric acid/gypsum, sodium sulphite, magnesium oxide, carbon adsorption and copper oxide.

14699 (PB—80-198518) Source emission measurements of volatile organic chemicals. Final report September 1978-December 1979. Scheil, G.W.; Bergman, F.J.; Owens, H. (Midwest Research Inst., Kansas City, MO (USA)). Jul 1980. Contract EPA-68-02-2977. 48p. NTIS, PC A03/MF A01.

Analytical methods for measuring volatile organic compounds were reviewed. Two commercially available instruments were selected and evaluated in the laboratory; one was judged unacceptable. The other analyzer was evaluated during a limited field test; results were satisfactory and averaged 3% higher than results produced by a concurrently operated gas chromatograph system.

14700 (PB—80-198526) Evaluation of solid adsorbents for collecting atmospheric chlorinated hydrocarbons. Bidleman, T.F.; Billings, W.N.; Simon, C.G. (South Carolina Univ., Columbia (USA). Dept. of Chemistry). Jul 1980. 67p. NTIS, PC A04/MF A01.

The comparative efficiency of polyurethane foam (PUF) and Tenax-GC resin for collecting polychlorinated biphenyls (PCB) and chlorinated pesticides from 300-1600 cu m air was determined by side-by-side sampling with each adsorbent in the city of Columbia, South Carolina.

14701 (PB—80-198690) An inventory of carcinogenic substances released into the ambient air of California. Volume I - Final report: screening and identification of carcinogens of greatest concern (Task I and III). Margler, L.; Ziskind, R.; Rogozen, M.; Axelrod, M. (Science Applications, Inc., Los Angeles, CA (USA)). 19 Feb 1979. Contract ARB-A7-161-30. 104p. NTIS, PC A06/MF A01.

This report identifies eleven candidate carcinogenic substances released into the ambient air of California. These selected substances, related to mining and manufacturing industries in California, were the consensus of the authors, after reviewing published lists, rankings and assessments of national scope, applying additive and multiplicative algorithms to further screen the original list of potential candidates, and after final critiquing of 22 candidate substances by a panel of experts convened by SAI. Those substances which had no significant use in the state were deleted. Ubiquitous substances as nitrous acid, nitric oxide and secondary amines, considered precursors to the formation of nitrosamines, were likewise not considered because of uncertainties in the importance of their link to the carcinogenic compounds. The eleven substances of concern in California are: arsenic, asbestos, benzene, cadmium, carbon tetrachloride, chloroform, ethylene dibromide, ethylene dichloride, nitrosamines, perchloroethylene and polycyclic organic material (POM).

14702 (PB—80-198708) An inventory of carcinogenic substances released into the ambient air of California. final report -Task II and IV. Roberts, R.M. (KVB, Inc., Tustin, CA (USA); Science Applications, Inc., Los Angeles, CA (USA)). Mar 1980. Contract ARB-A7-167-30. 325p. NTIS, PC A14/MF A01.

Task II of this report locates suspected California sources of the eleven candidate carcinogenic materials identified in Volume I and inventories the emissions. Task IV discusses in considerable detail methodologies for the sampling and assaying of the candidate carcinogens. Seventeen prime emission sources are identified in Task II including a major steel mill, several refineries and chemical manufacturers, secondary smelters, power utilities and asbestos mining and manufacturing operations. Annual estimated emissions range from 1.5-150 tons per year. Three candidate materials, chloroform, ethylene dibromide and nitrosamines are either emitted in insignificant amounts or are emitted by area sources not amenable to sampling within the confines of the project. Generally, recommended sampling for the remaining compounds utilize the Environmental Protection Agency's Method 5 sampling train, modified for certain materials. Recommended analytical methods include gas chromatography, mass spectrometry, high performance liquid chromatography or a combination of these methods, including photometry. Atomic absorption utilizing graphite furnaces may be used for metals analysis. Methods for the sampling and analysis for arsenic, asbestos and polycyclic organic materials (POM) require special considerations.

14703 (PB—80-198799) Kinetic and photochemical data for atmospheric chemistry reactions of the nitrogen oxides. Final report January-December 79. Hampson, R.F. Jr. (National Measurement Lab. (NBS), Washington, DC (USA)). May 1980. Contract DOT-FA79WAI-005. 95p. NTIS, PC A05/MF A01.

This report contains 24 individual data sheets for thermal and photochemical reactions of importance in the atmospheric chemistry of the nitrogen oxides. For each reaction the available experimental data are summarized and critically evaluated, and a preferred value of the rate coefficient is given. The selection of the preferred value is discussed and an estimate of its accuracy is given. For the photochemical process the data are summarized, and preferred values for the photoabsorption cross section and primary quantum yields are given. These data sheets were prepared by the author for the evaluation by the CODATA Task Group on Chemical Kinetics to be published in the Journal of Physical and Chemical Reference Data.

14704 (PB—80-198872) Digest of ambient particulate analysis and assessment methods. Final report. Throgmorton, J.A.; Axetell, K. (PEDCo-Environmental, Inc., Kansas City, MO (USA)). Sep 1978. Contract EPA-68-02-2603. 208p. NTIS, PC A10/MF A01.

A compendium of techniques is provided which describes approximately 25 techniques for analysis and interpretation of ambient particulate data. The techniques can be grouped categorically as follows: Temporal Patterns; Spatial Patterns; Meteorological Effects; Emissions Assessment; Interpreting Chemical, Elemental and Morphological Data; and Interpreting Particle Size Data. The techniques are described briefly, and references for a more thorough treatise of the subject are provided. The techniques span a range of complexity, cost and effectiveness. They are evaluated in terms of cost effectiveness and resource requirements. The digest provides the user with guidelines on the use of the techniques in terms of their problem applicability, resource requirements and interrelationships. It provides a framework for designing studies or analyses to interpret data from ambient particulate or any similar pollutant.

14705 (PB—80-198989) Atmospheric measurements of selected toxic organic chemicals. Interim report. Singh, H.B.; Salas, L.J.; Smith, A.; Shigeishi, H. (SRI International, Menlo Park, CA (USA)). Jul 1980. 77p. NTIS, PC A05/MF A01.

Atmospheric concentrations of 37 selected toxic organic chemicals, including aromatic hydrocarbons, halohydrocarbons, and secondary organic pollutants were measured under varying meteorological and source-strength conditions at several urban locations - Los Angeles, California; Phoenix, Arizona; and Oakland, California. Ambient air measurements of these chemicals were conducted from a suitably equipped mobile laboratory using specifically developed analytical techniques. Preliminary results on concentrations and variability, average daily exposure dosage, diurnal behavior, and atmospheric distribution, abundance, and fate are presented.

14706 **(PB—80-199003) ENAMAP-1 long-term air pollution model: adaptation and application to eastern North America. Final report, August 1978-March 1980.** Bhumralkar, C.M.; Mancuso, R.L.; Wolf, D.E.; Thuillier, R.A.; Nitz, K.C. (SRI International, Menlo Park, CA (USA)). Jul 1980. Contract EPA-68-02-2959. 103p. NTIS, PC A06/MF A01.

The long-term EURMAP-1 model, a trajectory-type regional air pollution model extensively evaluated and applied in Europe in conjunction with studies of interregional sulfur transport and deposition, was adapted, tested, and applied to eastern North America. The adapted version, ENAMAP-1, was used to calculate monthly, seasonal, and annual distributions of sulfur dioxide and sulfate (SO2 and SO4(-2)) concentrations and wet and dry depositions over the eastern United States, as well as over the southern portions of the Canadian provinces of Quebec and Ontario. This geographical area was partitioned into 13 different regions and interregional sulfur exchanges calculated. Model calculations were based on emission data that included both the specialized data prepared for the Sulfate Regional Experiment (SURE) and the U.S. Environmental Protection Agency's National Emissions Data System (NEDS). Model results using emissions and meteorological data for the year 1977 are presented. Results include tables showing the calculated interregional exchanges of sulfur deposition between 13 regions of eastern North America. Comparisons were made between calculated and measured SO2 and SO4(-2) concentrations. Calculated and measured values show reasonable agreement and indicate that improvements in the calculated values may be achieved by refinements in the modeling of mixing heights and stability. Results are also shown for an application of the model using projected 1985 emissions in conjunction with meteorological data for 1977.

14707 **(PB—80-199276) Hazard evaluation and technical assistance report No. Ta 79-2, Department of Tranportation, Vehicle Inspection Stations, Washington, DC.** Gorman, R.W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1979. 23p. NTIS, PC A02/MF A01.

Atmospheric air samples were analyzed, and pre- and post-shift carboxyhemoglobin levels were measured to determine employee exposures to carbon monoxide (630080), lead (7439921), asbestos (1332214), hydrogen sulfide (7783064) and sulfur dioxide (7446095) at the Northeast and Southwest Vehicle Inspection Stations (Standard Industrial Classification 754) in Washington, DC, on November 7 and 8, 1978. The survey was requested by the Office of Administration, Department of Transportation, Government of the District of Columbia, to evaluate exposures of approximately 18 inspectors during routine vehicle inspections. All asbestos, hydrogen sulfide, and sulfur dioxide concentrations were below detectable limits. Carbon monoxide and lead concentrations were below the OSHA standards of 50 parts per million and 20 milligrams per cubic meter, respectively, for an 8 hour time weighted average (TWA) at both facilities. Exposures were affected by weather conditions and the number of vehicles tested daily. The investigator concludes that fluctuating concentrations hampered the evaluation of long term health effects. There was a potential for high exposures to lead and carbon monoxide, especially at the busier Southwest station. Local and increased ventilation at the first and last inspection stops, preemployment cardiovascular medical examinations, personnel rotation, air conditioned squad rooms, vehicle number limitations, daily vacuuming, use of gloves, hand washing, scheduled inspections, and education concerning the hazards of smoking are recommended by the author.

14708 **(PB—80-199821) Air pollution concentrations associated with stagnation and restricted visibility, Eastern North America, August 1976.** DeMarrais, G.A. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Jul 1980. 82p. NTIS, PC A05/MF A01.

August 16 to 22, 1976, was designated as a stagnation period for a large part of the eastern United States by the Korshover technique, and Lyons and his associates judged August 16 to 28 to be a stagnation period. The effect of the 13 days of stagnation on five pollutants (total suspended particulates, carbon monoxide, sulfur dioxide, ozone and sulfates) and the association of various pollutants with restricted visibility are discussed in detail. Because long-range transport contributes to high concentrations of pollutants, trajectory analyses are included to indicate the approximate source-receptor relationships.

14709 **(PB—80-205347) Laser-Raman point monitoring of CH4 vapor in the LNG storage field. Final report, 1 January-31 December 1979.** Chang, R.K.; Benner, R.E. (Yale Univ., New Haven, CT (USA). Dept. of Engineering and Applied Science). Dec 1979. Contract GRI-5014-363-0146. 39p. NTIS, PC A03/MF A01.

Using an eight-component hydrocarbon gas which simulated the contents of natural gas, the authors have demonstrated that unique Raman signatures for each species exist and real-time Raman monitoring of each species is possible by detection with an optical multichannel analyzer which can measure simultaneously a large portion of the Raman spectrum. Furthermore, they have investigated the feasibility of using optical fibers to guide the laser radiation to a remote probe site and to collect/guide the Raman scattered radiation back to the detection system.

14710 **(PB—80-205859) Ambient air monitoring for benzene. 24-hour integrated sampling in six cities. Final report, 1 June 1977-1 April 1980.** Martin, B.E.; Clark, T.; Bumgarner, J.; Evans, G.F. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). May 1980. 41p. NTIS, PC A03/MF A01.

This monitoring program was initiated to assess the population exposure to ambient levels of benzene in conjunction with the announcement of benzene as a hazardous material. The program was conducted during the summer and fall of 1977. Average benzene concentrations of 5, 18, and 19 microgram/cu in, respectively, were measured in the widely separated cities of Dallas, Chicago, and Los Angeles. The precision of these data is estimated to be + or - 26 percent of the measured values. The improvement of benzine monitoring and analysis technology was an important secondary objective of this program. However, further research is needed to identify a more favorable collection medium than the Tenex that was used in this study.

14711 **(PB—80-205883) A summary of the interlaboratory source performance surveys for EPA reference methods 5, 6, and 7 - 1978. Final report.** Fuerst, R.G.; Midgett, M.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). May 1980. 58p. NTIS, PC A04/MF A01.

A national survey of methods in stationary source tests was conducted in 1978 by the Quality Assurance Division of the Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. In this program, quality assurance samples were sent to interested participants for the measurement of a gas volume (Method 5, dry gas meter only) or the analysis of liquid samples simulating collected sulfur dioxide and nitrogen oxides (Method 6 and 7, respectively). Each participant returned the analytical results to the Source Branch, Quality Assurance Division, for evaluation. An individual report was returned to each participant after processing. This report summarizes the survey results for those three source test methods.

14712 **(PB—80-207947) Study of automotive emission control technology: fuel switching analysis. Interim report No. 5 (final).** (Falcon Research and Development Co., Buffalo, NY (USA)). 30 Jun 1980. Contract 2-AQ-7243. 236p. NTIS, PC A11/MF A01.

This interim report examines the emissions impact of fuel switching on operating vehicles designed to use unleaded gasoline or leaded gasoline, one of the major factors responsible for the failure of in-use vehicles to meet emission standards. An analysis is made of the number of vehicles subject to fuel switching, the frequency at which it occurs, and the impact on individual vehicle emissions. A methodology is developed for predicting the total vehicle emissions impact of fuel switching, and projections are made of the increase in vehicle emissions from 1975 through 1990.

14713 **(PB—80-208382) Report of the photochemical oxidant panel to the National Commission on Air Quality. Final report.** Shutler, N.D. (Deane, Snowdon, Shutler, Garrish and Gherardi, Washington, DC (USA)). May 1980. Contract 4-AQ-7366. 69p. NTIS, PC A04/MF A01.

The Photochemical Oxidant Review Panel assembled by the National Commission on Air Quality met in January, 1980 to provide advice and develop recommendations to the Commission with respect to the formation and control of photochemical oxidants (ozone). The Panel considered these issues: the natural sources of ozone and its precursors, transport of ozone and its precursors, optimum HC/NOx controls, methods for assessing ozone/precursor relationships, priority areas for research and development, and geographical regions of the country which should be research priorities.

14714 **(PB—80-810773) Acid rain. 1975-April, 1980 (citations from the International Aerospace Abstracts data base). Report for 1975-April 80.** Gallagher, M.K. (New Mexico Univ., Albuquerque (USA). Technology Application Center). May 1980. 13p. NTIS PC N01/MF N01.

These citations from the international literature describe acid precipitation and its effects on the environment. Topics covered include: air pollution, pollution monitoring, atmospheric composition, meteorological parameters and ecosystems. (Contains 67 citations)

14715 **(PB—80-810955) Air pollution emission factors. 1964-May 1980 (citations from the NTIS data base). Report for 1964-May 1980.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jun 1980. 233p. NTIS PC N01/MF N01.

Emission factors for various industry, stationary, and mobile sources are presented in this annotated bibliography of research reports. The calculation and use of these factors are included. (This updated bibliography contains 226 abstracts, 33 of which are new entries to the previous edition.)

14716 **(PB—80-812332) Aircraft air pollution. 1977-June, 1980 (citations from the NTIS Data Base). Report for 1977-Jun 80.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 215p. NTIS PC N01/MF N01.

Citations include pollution control and abatement, emissions data and emission factors, stratospheric pollution, effects the supersonic transport traffic have on the environment, and pollutant concentrations and movement around airports and flight corridors. (This updated bibliography contains 209 citations, 65 of which are new entries to the previous edition.)

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 13500, 14000, 14757

14717 **(NUREG/CR—1316) Solubility classification of airborne uranium products collected at the perimeter of the Allied Chemical Plant, Metropolis, Illinois.** Kalkwarf, D.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RLO1830. 35p. NTIS, PC A03/MF A01.

The purpose of this study was to collect airborne uranium products at the perimeter of the uranium-conversion plant operated by the Allied Chemical Corporation at Metropolis, Illinois, and to classify the dissolution rates of these products in terms of the ICRP Task Group Lung Model. The International Commission on Radiological Protection developed this model for use in computing the radiation dose from radionuclides deposited in the lung. A key parameter is the classification of the deposited material according to the rate at which it leaves the lung. Three classes were established: D, W, and Y, corresponding to half-times in the lung of 0 to 10 days, 11 to 100 days, and > 100 days, respectively. If clearance of the material from the lung is not strictly exponential with time, it is approximated by a sum of exponentials; and the material is classified according to the fractions of D, W, and Y components. Assignments were based on measurements of the dissolution half-times exhibited by uranium components of the dust samples as they dissolved in simulated lung fluid at 37C. Although endocytosis and ciliary-mucus transport are known to contribute to lung clearance, experiments have indicated that a few days after dust deposition, dissolution determines the clearance rate for the lower respiratory tract.

14718 **Tritium population dose in the northern hemisphere.** Travis, C.C.; Gentry, R.D. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 88-89(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14719 **Comparison of observed and predicted doses from the TMI incident.** Miller, C.W.; Cotter, S.J.; Little, C.A.; Moore, R.E. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 90-91(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

5006 Regulations

REFER ALSO TO CITATION(S) 13366, 13532, 14653, 14676, 14697, 14768, 14795, 14797

14720 **(PB—80-187610) Incentives for technological innovation in air pollution reduction: an ETIP policy research series. Volume 1. Emission offset policy at work: a summary analysis of eight cases. Final report.** Foskett, W.H. (Performance Development Inst., Washington, DC (USA)). Apr 1980. Contract NBS-78-3603. 50p. NTIS, PC A03/MF A01.

The Emission Offset Interpretative Ruling of 1976 is analyzed into its administrative components. Eight permit applications involving emission offsets provide data describing the administrative functioning of the offset policy in terms of these components. In the eight cases presented here, offsets were easy to find, but the process for determining Lowest Achievable Emission Reduction (LAER) was typically quite complex. Offsets were not bought and sold in any of these cases. Third parties promoting local economic development were an important factor in locating offsets. In these eight cases, technological innovation involved development of new control techniques and diffusion of known technology to hitherto uncontrolled sources of emissions. 'Technology-forcing' standards, such as LAER, and offset requirements contributed to the development of innovative control techniques.

14721 **(PB—80-192750) Source category survey: secondary copper smelting and refining industry. Final report Oct 79-Jan 80.** Snyder, M.K.; Shobe, F.D. (Midwest Research Inst., Kansas City, MO (USA)). May 1980. Contract EPA-68-02-3059. 67p. NTIS, PC A04/MF A01.

This report presents the results of a survey of the secondary copper smelting and refining industry to determine the probable impact of the development of new source performance standards under Section 111 of the Clean Air Act. The surveyed industry processes copper scrap to produce pure copper or copper alloy, other than brass and bronze. Secondary copper foundries, which melt and cast high-quality copper scrap without refining it, are excluded. Primary copper smelters and refiners, which produce copper from ore, are also excluded, although they also process copper scrap. Process, emissions, and economic data were gathered by literature searches, contacts with representatives of the industry, trade associations, federal government agencies, and state and local air pollution control agencies, and visits to two plants. The industry's production processes, actual and allowable air emissions, and emission control systems are described. State and local emission regulations are compared. Production and capacity are projected to 1989 and the impact of new source performance standards is assessed.

14722 **(PB—80-192982) Environmental protection and the tenth five-year plan, (USSR).** Mote, V.L. (Houston Univ., TX (USA)). 1979. 24p. NTIS, PC A02/MF A01.

The principal measures to which the USSR state investments are directed are: pollution monitoring; pollution abatement (absorb-

ing the majority of the money); comprehensive use of resources; environmental forecasting and impact analyses in the reconstruction, design and placement of industrial facilities, particularly in Siberia and the sub-arctic. All this clearly reflects a change in tone and, a higher respect for the environment in Soviet state planning, to wit: a rational-growth policy.

14723 **(PB—80-193303) Source category survey: industrial incinerators. Final report.** (Acurex Corp., Morrisville, NC (USA)). May 1980. Contract EPA-68-02-3064. 192p. NTIS, PC A09/MF A01.

The report contains background information which was used for determining the need for new source performance standards (NSPS) for industrial incinerators in accordance with Section 111 of the Clean Air Act. The industrial incinerator population is surveyed and categorized by process type, capacity, class of owner, and other factors. Incinerator designs, control strategies, and state and local regulations are discussed. The impact of a potential NSPS on particulate emissions is calculated.

14724 **(PB—80-193949) Summary of state implementation plan revision program for Puerto Rico, total suspended particulates and sulfur dioxide. Final report.** (Engineering-Science, Inc., McLean, VA (USA)). Nov 1979. Contract EPA-68-02-2537. 121p. NTIS, PC A06/MF A01.

As part of the assistance provided to the states by EPA, Engineering-Science (ES) received several task orders to provide services to the Commonwealth of Puerto Rico Environmental Quality Board (EQB). The authors' efforts began in 1974 and have continued to the present time. The projects that resulted from the task orders deal with State Implementation Plan Revisions required by EPA. Maintenance and attainment of the ambient air quality standards for TSP and SO2 were addressed. This report presents a chronological summarization and consolidation of the efforts conducted by ES. For each task order, a summary of the initiation date, description, and report title and date is provided in Chapter I. Chapter II summarizes and consolidates the technical accomplishments of the studies, while Chapter III identifies areas in which refinements could be made and additional studies are appropriate. Little technical detail is covered in this report but can be found in the various reports documenting the work or in the Puerto Rico SIP.

14725 **(PB—80-194657) Impact of new source performance standards on 1985 national emissions from stationary sources. Final report jul 74-jul 76.** Hopper, T.G.; Marrone, W.A. (Research Corp. of New England, Wethersfield, CT (USA)). Apr 1977. Contract EPA-68-02-1382. 177p. NTIS, PC A09/MF A01.

The purpose of this document is to present the results of a study to determine the impact of new source performance standards on nationwide emissions. The work presented covers 14 potential pollutants from approximately 200 source categories for the year 1985. The results are being used by EPA as input to the development of an overall standard setting strategy. The report contains information regarding controlled and uncontrolled emission factors, State emission limitations, industrial capacity, utilization, growth and retirement rates. The results of this study have been published as three volumes which encompass ten separate documents. This document contains the main text and Appendices I through III of Volume I. All input/output variables and results are summarized and tabulated in this volume.

14726 **(PB—80-194665) Engineering reference manual for coding NEDS (national emissions data system) and EIS/P and R (emission inventory subsystem/permits and registration) forms.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Monitoring and Data Analysis Div.). Apr 1980. 41p. NTIS, PC A03/MF A01.

This manual provides specific engineering guidance and background information for the evaluation and reporting of source/emissions data in NEDS or EIS/PandR format. The manual is designed to assist coders of NEDS and EIS/PandR data who may not be familiar with a wide variety of industrial processes. It summarizes the purpose and organization of the manual. It also presents general coding instructions to supplement those given in other NEDS and EIS/PandR technical references, and presents general guidance regarding the use of NEDS Source Classification Codes (SCCs).

14727 **(PB—80-194822) Source category survey: perlite industry. Final report.** (Acurex Corp., Morrisville, NC (USA)). May 1980. Contract EPA-68-02-3064. 65p. NTIS, PC A04/MF A01.

Background information is presented on the perlite industry for the purpose of determining the need for a new source performance standard (NSPS). The industry is surveyed and categorized by plant, process, and other factors. Information is presented on processes, emissions and air pollution control equipment. State and local regulations are summarized. The impact of a potential NSPS on particulate emissions is calculated.

14728 **(PB—80-194913) Standards of performance for new stationary sources - a compilation as of January 1, 1979. Report for Nov 77-Jan 79.** (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Jan 1979. Contract EPA-68-01-4147. 352p. NTIS, PC A16/MF A01.

This document contains those pages necessary to update Standards of Performance for New Stationary Sources - A Compilation, published by the U.S. Environmental Protection Agency, Division of Stationary Source Enforcement in November 1977 (EPA 340/1-77-015). It is only an update and should be used in conjunction with the original compilation. Included in the update, with complete instructions for filing, are: a new cover, title page, and table of contents; a new summary table; all revised and new Standards of Performance; the full text of all revisions and standards promulgated since November 1977; and all proposed standards or revisions.

14729 **Environmental regulation: solutions to the regulatory maze.** Newman, D.T. (ed.). Santa Monica, CA; Legal Education Institute (1979). 983p. (CONF-8005144—). California Business Law Institute, Santa Monica.

From Conference on environmantal regulation: solutions to the regulatory maze; Chicago, IL, USA (20 May 1980).

The twenty-seven papers presented at the conference are divided among the following eight categories: federal air pollution controls/state and local air pollution controls; federal water pollution controls/state and local water pollution controls; federal hazardous waste disposal controls (RCRA)/state and local hazardous waste disposal controls; toxic substances control standards; pesticides use control; fast track energy legislation; impact on environmental requirements; other important environmental (including ocean dumping, drinking water, and noise controls); and specific corporate strategies for environmental compliance. (JGB)

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 14650, 14801, 14837, 14858, 14859, 14860, 14861

14730 **(DOE/EV/10026—2) Development of a center for biosystematics resources. Summary report, November 1, 1979-October 31, 1980.** Edwards, S.R. (Kansas Univ., Lawrence (USA). Museum of Natural History). Nov 1980. Contract AC02-79EV10026. 9p. NTIS, PC A02/MF A01.

The objective in the development of a Center for Biosystematics Resources is to provide a centralized source of information regarding the biological expertise available in the academic/museum community; and the federal and state regulations concerning the acquisition, transport, and possession of biological specimens. Such a Center would serve to facilitate access to this widely dispersed information. The heart of the Center is a series of computer assisted data bases which contain information on biologists and their areas of expertise, biological collections, annotated federal regulations, and federal and state controlled species lists. In the last year these data bases have been updated and expanded. Additional data bases have been constructed and are being maintained. The

purpose of this three-year contract with the Department of Energy is to continue the updating and revision of the original data bases, make the information they contain readily available to the Department of Energy, other government agencies, the private sector, and the academic community; and to achieve financial independence by the end of the three-year period.

14731 **Transpiration and CO_2 fixation of selected desert shrubs as related to soil-water potential.** Clark, S.B.; Letey, J. Jr.; Lunt, O.R.; Wallace, A.; Kleinkopf, G.E.; Romney, E.M. *Great Basin Nat.;* No. 4, 110-120(1980).

In desert plants, transpiration rates decreased before photosynthetic rates when plants were entering a period of water stress. This may have adaptive consequences. A difference of -5 bars in the soil-moisture potential had considerable importance in reducing the rate of transpiration. In Helianthus annuus L. (sunflower) the photosynthetic rate decreased before the transpiration rate in contrast to Great Basin-Mojave Desert plants, and the changes occurred with a -1 bar difference in soil-moisture potential. Morphological changes in three desert plant species [Artemisia tridentata Nutt., Ambrosia dumosa (Gray) Payne, Larrea tridentata (Ses. Moc. ex DC) Cov.] as the soil-moisture potential decreased are given. With a mesic species, H. annuus, 20% reduction in photosynthesis and transpiration was reached at higher soil-moisture potentials than with the desert plants. Loss of net photosynthesis occurred in A. dumosa (a summer deciduous shrub) as PSI soil reached -48 bars in the field, whereas L. tridentata (an evergreen shrub) at the same time was able to maintain a water potential difference between soil and plant of -10 to -15 bars and continue net CO_2 gain well into the summer months.

14732 **Socioecological and soil-plant studies of the natural vegetation in the northern Mojave Desert-Great Basin Desert interface.** El-Ghonemy, A.A. (University of Tanta, Egypt); Wallace, A.; Romney, E.M. *Great Basin Nat.;* No. 4, 73-88(1980).

The purpose of this study is to further describe the distribution, habitats, and ecological characteristics of the natural vegetation in the northern sector of the northern Mojave Desert. Sixty-six stands were classified on the basis of shared leading dominant species. Each of these groupings is well defined and represents a sociologically distinct entity quite recognizable in the field. The relationships between each vegetational grouping and several environmental variables were statistically analyzed. Significant differences were found among plant groupings with respect to soil moisture tension, absolute and relative amounts of exchangeable Na, exchangeable K, cation exchange capacity, and elevation. The analysis of the relationship between the phytosociological behavior of the major leading dominant species and the environmental variables shows that some of the simple, or multiple, linear correlations obtained with regard to Larrea tridentata were highly significant. Atriplex confertifolia and Atriplex canescens showed the highest number of significant correlations obtained. Diversity varies from one vegetational grouping to the other as well as between stands of the same grouping. The grouping of L. tridentata has proved to be the most widespread, diversified, and consequently the most stable vegetation cover in the study area; it, therefore, represents a climate community. The vegetational grouping dominated by A. confertifolia, on the other hand, appears not to be a climax community.

14733 **Frequency distribution of numbers of perennial shrubs in the northern Mojave Desert.** El-Ghonemy, A.A. (University of Tanta, Egypt); Wallace, A.; Romney, E.M. *Great Basin Nat.;* No. 4, 34-38(1980).

Frequency distribution according to plant size as measured by dimensional analysis on different mathematical bases were determined for 10 common perennial plant species from Rock Valley in the northern Mojave Desert in Nevada. A total of 4282 individual plants was measured. The data provide information concerning the stability and prosperity of the natural vegetation as judged by the relative proportions of individuals in the size-class spectrum, as well as show graphically the relative abundance of the different species in the study area. On the species level, the populations were close to normally distributed on the log/sub e/ basis, but with remarkably negative skewness due to better segregation of the small-sized individuals into many segmental units. On the arithmetic basis, three categories of frequency pattern were recognized, but all with marked positive skewness due to better segregation of large-sized individuals into many segmental units. The feature common to all species studied is the preponderance of young individuals, which in many cases could have an abundance many times that of large individuals. The natural vegetation in Rock Valley, therefore, represents a reasonably active stage.

14734 **Role of shrubs on redistribution of mineral nutrients in soil in the Mojave Desert.** Romney, E.M.; Wallace, A.; Kaaz, H.; Hale, V.Q. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 124-133(1980).

Soil profiles underneath shrub clumps and bare desert pavement were examined at 62 study sites located in both open and closed drainage basins of the northern Mojave Desert. Highly significant differences occurred in the root zone underneath shrub clumps with higher concentrations of the following soil properties: electrical conductivity ($EC25^0$), Na, K^+, Ca^{++}, Mg^{++}, Cl^-, NO_3^-, and SO_4/sup =/; exchangeable K^+; cation exchange capacity; organic C and N; available P, and DTPA-extractable Fe and Mn. These differences reflect differential cycling caused by different plant species. The decomposition and mineralization of litter deposited underneath the perennial vegetation can account for these differences in soil properties which, collectively, increase the fertility of the soil underneath the vegetation canopy. Aboveground biomass of shrubs was measured and the nitrogen and mineral element composition of new photosynthetic tissue was determined. Estimates from a representative study site indicate that the reservoir of nitrogen and mineral nutrients in new leaf material of shrubs available for litter deposition could contribute 3.64 kg N, 0.31 kg P, 0.57 kg Na, 5.20 kg K, 4.95 kg Ca, 31.82 g Fe, and 4.30 g Mn per hectare. This source probably represents about one-third of the total amount of nutrients involved in annual turnover for the study area during a normal production year. The remaining contribution would be supplied from the standing dead wood in shrubs and as litter from annual plant species.

14735 **Pulse hypothesis in the establishment of Artemisia seedlings at Pahute Mesa, Nevada.** Romney, E.M.; Wallace, A.; Hunter, R.B. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 28-30(1980).

New Artemisia seedlings are not established each year. Many that are established fail to survive because of unfavorable rainfall in succeeding years. A total of 184 young plants was examined for the number of annual growth rings to ascertain the year of establishment after all vegetation had been killed near the time of a nuclear test event in 1965. The three most important recent years for establishment and survival of new seedlings (as of 1976 and based on a sample of 184 plants) were 1966 (9 percent), 1969 (29%), and 1973 (36%). A total of 27% was established in the other years from 1965 to 1976. These three years were also the years with high rainfall input during preceding winter and spring months. If old plants are killed, seeds germinate with much lower inputs of precipitation. Many seedlings germinated in 1968 at a site where old ones had been burned off even though the rainfall was not favorable. Plants of a given age varied greatly in size according to their competition. Seedlings germinating in old stands grew little in comparison with those germinating in areas where old plants had been killed. One exception was an area where intense competition occurred due to large numbers of new plants, resulting in growth restriction on all plants.

14736 **Relationship of small washes to the distribution of Lycium andersonii and Larrea tridentata at a site in the northern Mojave Desert.** Wallace, A.; Romney, E.M.; Hunter, R.B. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 94-97(1980).

At a site near Rock Valley, Nevada, dominated by volcanic rocks, both Larrea tridentata (Sesse and Moc. ex DC.) Cov. And Lycium andersonii A. Gray were restricted in distribution. Larrea tridentata did not grow in the many small washes in the area, but L. andersonii grew only in the washes. Ambrosia dumosa (A. Gray) Payne was more dense and more dominant in wash areas than in nonwash areas.

14737 **Regulative effect of dodder (Cuscuta nevadensis Jtn.) on the vegetation of the northern Mojave Desert.** Wallace, A.; Romney, E.M.; Hunter, R.B. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 98-99(1980).

On two separate transects in the Rock Valley area of the northern Mojave Desert in the spring of 1976, 4 to 17% of the perennial plants were infested with the parasite Cuscuta nevadensis Jtn. (dodder), and dead pieces of dodder from previous years were on dead plants equivalent to another 5%, indicating that the dodder had a regulating effect on the plant population and may be an important cause of perennial plant death.

14738 **Carbon fixed in leaves and twigs of field Larrea tridentata in two-hour exposure to $^{14}CO_2$.** Wallace, A.; Romney, E.M.; Hunter, R.B. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 121-123(1980).

Six Larrea tridentata (Sesse and Moc. ex DC) Cov. plants were exposed to $^{14}CO_2$ in a field experiment for 2 h. Three of the plants had been irrigated regularly in the preceding year. Ten small twigs from each plant were removed and counted for ^{14}C activity at the end of 2 h. The stem portion of the twigs was of equal dry weight for the two sets of plants, but those irrigated had a greater weight of leaves per twig. The activity of ^{14}C in leaves was equal for the two groups, but was higher in stems for watered plants than for unwatered plants. The results were best expressed as ratios. Dry weight of leaves divided by dry weight of stems was high for watered plants; cpm/g dry weight of leaves divided by cpm/g dry weight of stems was higher for unwatered plants. In another experiment in which leaves were removed before exposing stem portions of twigs to $^{14}CO_2$, small green stems accounted for about 1/8 the total photosynthesis for a plant; the coefficient of variation was around 100%.

14739 **Further attributes of the perennial vegetation in the Rock Valley area of the northern Mojave Desert.** Bamberg, S.A..; Wallace, A.; Romney, E.M.; Hunter, R.E. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 39-41(1980).

Above-ground and below-ground biomass, percent dead shrubs by species, and percent of dead stems of living species were determined for a site in the northern Mojave Desert.

14740 **Photosynthetic strategies of two Mojave Desert shrubs.** Kleinkopf, G.E.; Hartsock, T.L.; Wallace, A.; Romney, E.M. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 100-109(1980).

Photosynthetic production of two Mojave Desert shrubs was measured under natural growing conditions. Measurements of photosynthesis, transpiration, resistances to water vapor flux, soil moisture potential, and tissue water potential were made. Atriplex canescens (Pursh) Nutt., a member of the C_4 biochemical carbon dioxide fixation group was highly competitive in growth rate and production during conditions of adequate soil moisture. As soil moisture conditions declined to minus 40 bars, the net photosynthetic rate of Atriplex decreased to zero. However, the C_3 shrub species Larrea tridentata (Sesse and Moc. ex DC.) Cov. was able to maintain positive net photosynthetic production during conditions of high temperature and extreme low soil moisture through the major part of the season. The comparative advantages of the C_4 versus the C_3 pathway of carbon fixation was lost between these two species as the soil moisture potential declined to minus 40 bars. Desert plants have diffferent strategies for survival, one of the strategies being the C_4 biochemical carbon fixation pathway. However, many of the plants are members of the C_3 group. In this instance, the C_4 fixation pathway does not confer an added advantage to the productivity of the species in the Mojave Desert. Species distribution based on comparative photosynthetic production is discussed

14741 **Frequency distribution of three perennial plant species to nearest neighbor of the same species in the northern Mojave Desert.** Wallace, A.; Romney, E.M.; Kinnear, J.E. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 89-93(1980).

Frequency distribution patterns were developed for distance to nearest neighbor of the same species for Larrea tridentata (Sesse and Moc. ex DC.) Cov., Ephedra nevadensis S. Wats., and Acamptopappus shockleyi A. Gray. The distances between shrubs had been determined previously in another study. About one-third or more of the nearest neighbor of its own kind was within less than one meter for each species, indicating that it was usually within the same shrub clump, which in turn is indicative of an aggregating effect. For L. tridentata and E. nevadensis much of this could be from the same original plant by crown diffusion (L. tridentata) or underground spreading (E. nevadensis). None of the three gave evidence of spacing at regular intervals when the nearest neighbor of a single individual within a shrub clump was outside that clump. Rather, they appeared to be randomly distributed under this condition, except possibly for A. shockleyi.

14742 **Analysis of parameter error in a nonlinear model.** O'Neill, R.V.; Gardner, R.H.; Mankin, J.B. (Oak Ridge National Lab., TN). *Ecological Modelling ;* 8: 297-311(1980).

Solutions of a two-variable nonlinear model were studied by randomly selecting parameters from independent triangular distributions, with maximum and minimum parameter values equal to 10% of the expected value. Small coefficients of variation on parameter values can result in coefficients of variation on model output that are as much as an order of magnitude larger. Establishing limits of acceptable system behavior (error criteria) at four points in time reduced the total error and revealed significant variance-covariance relationships between parameters. With parameters drawn from a prespecified variance-covariance matrix, total error over the entire simulation was reduced by a factor of 4.8. Our results can be applied to improve the design of experiments used to estimate parameter values and validate model output.

14743 **Challenge of a desert: revegetation of disturbed desert lands.** Wallace, A.; Romney, E.M.; Hunter, R.B. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 216-225(1980).

The revegetation of disturbed, arid lands is one of the great challenges of a desert. An attempt to encourage it is not an impossible task, however, if the natural and the man-made resources available are utilized and managed. Where rainfall and temperature conditions approach or exceed those of the Great Basin desert, restoration of disturbed land will occur through natural revegetation processes within a reasonable period of time. This is not generally the case in the more arid Mojave Desert areas where the moisture and temperature conditions are less favorable for germination and seedling survival. Restoration of vegetation by natural reseeding can, however, occur within local sites where moisture has concentrated as the result of terrain features forming catchment basins. Otherwise, the natural revegetation processes in the Mojave Desert areas require much longer periods of time (possibly decades or centuries) than are practical for meeting environmental protection standards imposed by current legislation. Through better understanding of the processes governing revegetation and the ability to control them, it is possible for man to more rapidly restore disturbed desert lands. Terrain manipulation to form moisture catchment basins, selection of seed from pioneering shrub species, preservation of existing shrub clump fertile islands in the soil, supplemental fertilization, irrigation, organic amendments, and transplanting vigorous shrub species are some of the important things that can be done to help restore disturbed desert land.

14744 **Depth distribution of roots of some perennial plants in the Nevada Test Site area of the northern Mojave desert.** Wallace, A.; Romney, E.M.; Cha, J.W. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 201-207(1980).

The root systems of 48 perennial plants, representing nine species from the Rock Valley area within the northern Mojave Desert, were excavated by 10 cm depth increments to determine, by depth of soil, the distribution of roots larger than about 1/2 mm diameter. The depth of the root zone of all species was relatively shallow and obviously limited by depth of penetration of precipitation (about 10 cm mean annual rainfall). There were species differences, however, in distribution of roots. Even though a sizeable proportion of the root systems was in the first 10 cm of soil, this portion consisted largely of multiple woody tap roots with relatively few small roots. In all cases except one (Krameria parvifolia Benth), more small roots were in the second 10 cm than in the first.

From 50 to more than 80 percent of the total root systems were in the first 20 cm. In most cases the majority of small roots was found between 10 and 30 cm in depth. Very fine roots were sampled separately by depth and zone without regard for species because they could not be differentiatd by species. Relative depth distribution of very fine roots at Rock Valley for 0 to 10, 10 to 20, and 20 to 30 cm, was about 17, 42, and 41 percent, respectively. The total for the first 20 cm was 59 percent. On a 22 April date, there were 335 kg/ha roots from winter annuals in the Rock Valley area; 19 percent of them were in the first 5 cm of soil in contrast to 8 percent in 10 cm of soil for perennials. On Pahute Mesa located in the southern Great Basin desert area of the Nevada Test Site in Artemisia tridentata Nutt. varr. tridentata, 8 percent of the roots was in the first 5 cm, indicating more shallow rooting compared with the northern Mojave Desert.

14745 **Rodent-denuded areas of the northern Mojave desert.** Hunter, R.B.; Romney, E.M.; Wallace, A. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 208-211(1980).

Populations of pocket gophers and rabbits regulate or control the perennial vegetation on relatively large sites in the northern Mojave Desert. Aboveground shoots are pruned and whole plants are killed by complete cutting of main roots.

14746 **Fencing enhances shrub survival and growth for Mojave desert revegetation.** Hunter, R.B.; Romney, E.M.; Wallace, A. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 212-215(1980).

Fourteen species of native shrubs were transplanted to bare areas of the northern Mojave Desert in 1972 and 1973. By 1978 plants surrounded by small fences were larger (0.26 vs 0.11 m^3 overall average for several species) and survived better (42 percent versus 23 percent) than unfenced plants. These effects are primarily due to reduced grazing of shoots. Loss of shrubs to pocket gophers or other burrowing rodents was not prevented by fencing.

14747 **Mineral composition of Atriplex hymenelytra growing in the northern Mojave Desert.** Wallace, A.; Romney, E.M.; Hunter, R.B.; Kinnear, J.E.; Alexander, G.V. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 156-162(1980).

Fifty samples of Atriplex hymenelytra (Torr.) S. Wats. were collected from several different locations in southern Nevada and California to test variability in mineral composition. Only Na, V, P, Ca, Mg, Mn, and Sr in the samples appeared to represent a uniform population resulting in normal curves for frequency distribution. Even so, about 40 percent of the variance for these elements was due to location. All elements differed enough with location so that no element really represented a uniform population. The coefficient of variation for most elements was over 40 percent and one was over 100 percent. The proportion of variance due to analytical variation averaged 16.2 +- 13.1 percent (standard deviation), that due to location was 43.0 +- 13.4 percent, and that due to variation of plants within location was 40.7 +- 13.0 percent.

14748 **Frequency distribution and correlation among mineral elements in Lycium andersonii from the northern Mojave Desert.** Wallace, A.; Romney, E,M.; Alexander, G.V.; Kinnear, J.E. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 146-155(1980).

Two hundred samples of leaves of Lycium andersonii A. Gray, each representing one plant and divided among six different locations, were assayed by emission spectrography. Information for 12 different elements is reported in terms of concentrations, frequency distribution, correlations, and some soil characteristics. The objective was to ascertain the nature of variability for mineral elements within a species. Composition varied significantly for all 12 elements among locations, all within about 20 km. At least part of the variation was due to soil characteristics. Samples from Rock Valley were highest in K, Na, and Li, which effect is associated with volcanic outcrop. Samples from Mercury Valley were highest in P, Mg, Ba, and B. At least Mg is related to the soil composition. Correlation coefficients between element pairs were often very different for all 200 samples versus those obtained for individual locations. Some of the values for all 200 samples together proved to be artifacts. The highest correlation was for Ca x Sr (positive) and next was Ca x Mg (also positive). Most correlations were slightly or strongly positive (24 to 32). Only P x Ca, Ca x Na, Ca x B, and Sr x P seemed to be significantly negative of the 32 correlations examined. Frequency distribution patterns where common populations were grouped were often normally distributed. Li, as previously reported, and Na, Cu, Mn,and B and Ba at some locations were not normally distributed. Wide variations in the concentrations of individual elements in leaves of these species were encountered.

14749 **Parent material which produces saline outcrops as a factor in differential distribution of perennial plants in the northern Mojave Desert.** Wallace, A.; Romney, E.M.; Wood, R.A.; El-Ghonemy, A.A.; Bamberg, S.A. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 140-145(1980).

An area of 0.46 km^2 divided into six zones in the northern Mojave Desert transitional with the Great Basin Desert has been studied. Diversity is high among the perennial plant species within the 0.46 km^2 area. Common species for the two deserts that are present in the area studied are Atriplex confertifolia (Torr. and Frem.) S. Wats., Ceratoides lanata (Pursh) J.T. Howell, Grayia spinosa (Hook.) Moq., Ephedra nevadensis S. Wats. Some other species present include Lycium andersonii A. Gray, Lycium pallidum Miers, Ambrosia dumosa (A. Gray) Payne., Larrea tridentata (Sesse and Moc. ex DC) Cov., Acamptopappus shockleyi A. Gray, and Krameria parvifolia, Benth. Some of the species are relatively salt tolerant and some are relatively salt sensitive. A total of 4282 individual plants were measured. There was considerable variation in distribution of the 10 dominant species present, apparently due to zonal variations of salinity dispersed within the study area. Correlation coefficients among pairs of the species for different zones illustrate interrelationships among the salt-tolerant and salt-sensitive species. Observations on an adjacent hillside with rock outcroppings indicate that the saline differences in this area are partly due to outcroppings of parent volcanic rock materials that yield Na salts upon weathering.

14750 **Ecotonal distribution of salt-tolerant shrubs in the northern Mojave Desert.** Romney, E.M.; Wallace, A. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 134-139(1980).

Ecotonal distribution of salt-tolerant shrubs was investigated under different kinds of edaphic conditions common to open and closed drainage basins in the northern Mojave Desert. Contributing causal factors involved changes in soil salinity, texture, and moisture stress. Varying degrees of halophytism occurred, ranging from plant species that are facultative in their adaptation to salinity to those that require comparatively high salt concentrations in soil for normal growth and development.

14751 **(PB—80-176845) On 1012: a check on earth carrying capacity for man. Final report.** Marchetti, C. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 21p. NTIS PC E02/MF E02.

The report examines the issue of how much human population the earth can tolerate. The result of this analysis is that from a technological point of view a trillion people can live beautifully on the Earth, for an unlimited time, without exhausting any primary resource and without overloading the environment. The global view of the problems and of their solutions makes the difference, and shows that most of the physical limits to growth stem from an inappropriate frame of reference.

5102 Chemicals Monitoring And Transport

14752 **(PB—80-176373) Sampling and analysis of selected toxic substances. Task 1: polybrominated biphenyls in air and soil at user sites. Final report 28 dec 78-5 jun 79.** Zweidinger, R.A.; Pellizzari, E.D. (Research Triangle Inst., Research Triangle Park, NC (USA)). Feb 1980. 55p. NTIS, PC A04/MF A01.

Field sampling for air and soil was conducted in the vicinity of two Borg Warner Co. facilities - one in Oxnard, CA and the

other near Parkersburg, WV. Polybrominated biphenyls (PBBs) were found in all of the soil samples from Oxnard with the highest levels (36,000 microgram/kg) nearest the facility and the lowest (5 microgram/kg) upwind the greatest distance. No PBBs were found in any of the air samples (<3 ng/cu m). Polybrominated biphenyls were confirmed in seven of the thirteen soil samples from West Virginia (up to 12 microgram/kg) traces detected but not confirmed in three, and no PBBs were detected in the other three. The highest levels were from samples collected in the Ohio River basin especially along the eastern bank. No PBBs were confirmed in the air samples (<4 ng/cu m).

14753 **(PB—80-197619) Multimedia environmental goals for environmental assessment. Volume I. Supplement a. Report for October 1978-October 1979.** Kingsbury, G.L.; White, J.B.; Watson, J.S. (Research Triangle Inst., Research Triangle Park, NC (USA)). Mar 1980. Contract EPA-68-02-3132. 224p. NTIS, PC A10/MF A01.

The report supplements Volume I (PB-276 919) of the two-volume 1977 EPA report that introduced a methodology to establish Multimedia Environmental Goals (MEGs) for chemical pollutants. It summarizes the original methodology and introduces minor improvements. Improvements include the assignment of a unique identification number to each MEG compound and modification of the original model used to derive MEG values for land or solid waste. Its appendices include: revised category descriptions, an updated master list of organic compounds, a candidate list of compounds to be considered for future MEGs, tabulated discharge MEG values, and hazard potential values. It also includes graphical summaries of MEGs for 586 organic chemicals. The Supplement is to be used in coordination with MEG Volumes III and IV (PB80-115108 and PB80-115116) which contain background information summaries and MEG charts for organic compounds in the new MEGs master list.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 13494, 13548

14754 **(LA—8586-PR) Laboratory studies of radionuclide distributions between selected groundwaters and geologic media. Progress report, October 1, 1979-September 30, 1980.** Daniels, W.R. (comp.). (Los Alamos Scientific Lab., NM (USA)). Jan 1981. Contract W-7405-ENG-36. 75p. NTIS, PC A04/MF A01.

During FY-1980, Los Alamos Scientific Laboratory contributions to the Waste/Rock Interactions Technology program were primarily in the areas of migration-rate studies using crushed rock, whole core, and fractured core columns; parametric studies of variables which may influence radionuclide sorption-desorption behavior; and initial studies of actinide chemistry in near-neutral solutions and Eh control. Batch experiments in both air and a controlled atmosphere (nitrogen, ≦ 0.2 ppM oxygen, ≦ 20 ppM carbon dioxide) for the sorption of several radionuclides on granite and argillite were completed. These data also provided informaton on the effects of other parameters, such as particle size and contact time. All nine elements studied had different sorption ratios for argillite when measured under the controlled atmosphere than when measured in air, except possibly for americium where any effect was smaller than the standard deviations. As expected, strontium, cesium, and barium are least affected by the presence or absence of oxygen and carbon dioxide. Columns of crushed rock and solid and cracked cores were used to study the migration of radionuclides through such materials. In general, sorption ratios measured by batch techniques are 2 to 3 times greater than those for columns; however, a wide variation in behavior was observed, depending upon the element and the mineralogy. Work has begun on a system wherein traced groundwater is circulated through a crushed rock column; this should provide a link between the usual, single-pass, crushed rock columns and the batch experiments. Materials characterization has continued, and techniques for the determination of Fe(II) in silicate rocks and groundwater have been made operational. Work on the fundamental solution chemistry of the actinides has been started.

14755 **(NUREG/CR—1196) RAGTIME: a FORTRAN IV implementation of a time-dependent model for radionuclides in agricultural systems. Progress report no. 1.** Pleasant, J.C.; McDowell-Boyer, L.M.; Killough, G.G. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract W-7405-ENG-26. 108p. NTIS, PC A06/MF A01.

RAGTIME is a Fortran IV program used to calculate radionuclide concentrations in food crops, beef, and milk which are contaminated as a result of deposition of radioactivity on an agricultural area. Contamination of these foods is assumed to occur as a result of the deposition of radioactivity onto the surface of aboveground food crops, pasture grass, the soil surface below crops, and the soil surface or root mat below pasture grass, with ingrowth of radioactive daughters being computed explicitly. This report discusses the development of the model which is presently on-going, and thus, does not represent the final version envisioned for implementation. Output for a sample run of the current version is provided in this report.

14756 **(PB—80-205768) Above ground gamma ray logging of Edgemont, South Dakota and vicinity. Technical note (final).** Thrall, J.E.; Hans, J.M. Jr.; Kallemeyn, V. (Office of Radiation Programs, Las Vegas, NV (USA)). Feb 1980. 80p. NTIS, PC A05/MF A01.

This report summarizes the results of the 1971-72 and 1978 surveys to locate suspected tailings use areas. It also presents and discusses other gamma measurements made in and around Edgemont.

14757 **(PNL-SA—9018) Long term erosion resistance of unprotected radon suppression earth covers to wind stresses.** Bander, T.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Oct 1980. Contract AC06-76RL01830. 10p. (CONF-801155—2). NTIS, PC A02/MF A01.

From 3. annual symposium on uranium mill tailings management; Ft Collins, CO, USA (24 Nov 1980).

Estimates of the amount of soil cover lost due to wind erosion are obtained using three different models. One model developed by W. S. Chepil employs a wind erosion equation which is based on wind tunnel and agricultural field measurements. The second model is based on an analytical solution of the saltation process obtained by P. R. Owen and agrees well with the data of Bagnold and Zingg. The third model was developed by Gillette and is based on a modification of the horizontal flux equation used by Bagnold and Chepil. Basic differences between the models are examined and a comparison of the soil movement predicted by each is presented. The usefulness of these wind erosion models as guidance in designing long term erosion-resistant covers for tailings piles is considered.

14758 **Environmental surveillance in the Marshall Islands: an application of alternative energy sources in the Third World.** Greenhouse, N.A. Jr. (Brookhaven National Lab., Upton, NY). *Journal of the National Technical Association ;* **54**: No. 3, 38-44(Sum 1980).

Recent assessments of potential radiation exposure pathways at Bikini and Enewetak have indicated that doses in excess of current radiation protection guidelines are possible or even likely for persons living in these areas. Rongelap and Utirik Atolls, which were downwind of the 1954 BRAVO event, also received significant fallout; potential radiological problems exist in these areas as well. In view of this prospect, followup environmental monitoring and personnel monitoring programs are being established to maintain our cognizance of radiological conditions, and to take corrective action where necessary. Various aspects of this program require the operation of scientific equipment in remote areas which have no electrical power. In order to solve this problem, windpowered electrical generators were installed on three islands in a planned program through which they will be turned over to the local inhabitants for community use after about two years. This paper describes environmental surveillance efforts for the inhabitants of Pacific Islands who were the recipients of radioactive fallout from US nuclear weapons tests in the Pacific.

14759 **Transport of a radioactive salt through a semi-infinite column of porous medium: a physical model.** Lucas, J.N. (Univ. of California, Livermore). *Water Resources Research ;* **16**: No. 2, 387-390(Apr 1980).

A model study of the transport of radioactive tracer through a porous medium was carried out in columns of sand into which a radioactive salt solution, sodium-24 chloride, was introduced continuously. Mathematical equations were developed to describe the effluent concentration, for a semi-infinite column, during the transient phase for variable as well as for the constant input concentration. Furthermore, inspection of the relevant equation for effluent concentrations from long columns indicated that dispersion should be negligible in the steady state. The experimental data of effluent concentrations gave accurate agreement with the theoretical breakthrough curves predicted by the mathematical equations, and with the steady state concentration value.

14760 **Dynamic modeling of radionuclides in terrestrial food chains.** McDowell-Boyer, L.M. (Oak Ridge National Lab., TN); Killough, G.G.; Pleasant, J.C. *Transactions of the American Nuclear Society ;* **34**: 85(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14761 **Sorption studies at Hanford for the control of radioactive wastes.** Routson, R.C.; Barney, G.S.; Smith, R.M. (Rockwell Hanford, Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 117(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14762 **Plutonium/americium inventory of the Smart Ditch Pond ecosystem.** Hurley, J.D.; Winsor, T.F. (Rockwell International, Golden, CO). *Transactions of the American Nuclear Society ;* **34**: 133-135(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

5105 Site Resource And Use Studies

14763 **(DOE/EV/02270—T1) Energy budgets of animals: behavioral and ecological implications.** Porter, W.P. (Wisconsin Univ., Madison (USA). Dept. of Zoology). 1979. Contract AS02-76EV02270. 5p. NTIS, PC A02/MF A01.

This year's progress has been: (1) to extend the general microclimate model two ways: (a) to incorporate wet ground surfaces (bogs), and (b) to incorporate slope effects. Tests of the model in a Michigan bog and the Galapagos Islands show temperature accuracies to within 4°C at worst at any soil or air location, which is about a 2% error in estimation of metabolism. (2) The addition to ectotherm modeling an analysis of: (a) reproduction in heterogeneous and uncertain environments; (b) prediction of distribution limits due to egg incubation requirements; (c) addition of appendage-torso modeling and tests on large ectotherms; (d) social systems interactions with environmental and physiological variables; and (3) to continue the endotherm (deer mouse) experimental research and extend the growth and reproduction studies to include the entire reproductive and growth cycle in the deer mouse.

14764 **(NP—25238) Mixed woodchips and paper as a mulch for strip-mined land revegetation.** Brown, J.E.; Maddox, J.B. (Tennessee Valley Authority, Norris (USA). Div. of Land and Forest Resources). Nov 1980. 12p. NTIS, PC A02/MF A01.

The primary objective of this study was to test the effectiveness of combined hammermilled woodchips and paper mulch on establishment of vegetation. A secondary objective was to determine the application cost differences, if any, between the woodchips-paper mulch mix (WPM) and a standard mulch (Turfiber). The test was conducted on a Campbell County strip mine site in east Tennessee. WPM, applied at rates of (1) 1120 kg/ha, (2) 1680 kg/ha, and (3) 2241 kg/ha were compared with the standard recommended rate of Turfiber (1680 kg/ha). Vegetative cover produced during the first growing season with the lowest rate of WPM was as good as that produced on plots using the currently recommended rate of Turfiber. The recommended rate of Turfiber cost $1582 per hectare to apply, while comparible vegetative cover was obtained by using 1120 kg/ha of WPM at a cost of $1095 -- a savings of $487 per hectare.

14765 **(NP—25246) Survival and growth of wildlife shrubs and trees on acid mine spoil.** Fowler, D.K.; Adkisson, L.F. (Tennessee Valley Authority, Norris (USA). Div. of Land and Forest Resources). Jan 1980. 53p. NTIS, PC A04/MF A01.

The purpose of this study was to assess the survival and growth of selected wildlife plants over a wide range of acid mine spoil conditions and to identify species suitable for surface mine reclamation. A major criterion in selection of study sites was inclusion of a wide range of spoil acidity conditions. The Ollis Creek (Study Area A) and Farrell (Study Area B) coal surface mines located in Campbell and Scott Counties, Tennessee, were selected for study. Seven plant species, all of which had been used in past reclamation demonstrations, were introduced on the 22 plots during March 1972. Autumn olive (Elaeagnus umbellata) was included as a control plant. Ten additional plant species were introduced during March 1973. With the exception of highbush blueberry (Vaccinium corymbosum var.). European filbert (Corylus avellana), and red maple (Acer rubrum), these species had not been used in TVA reclamation demonstrations. To assess the effects of spoil pH on the plants, the plots were grouped into seven pH categories, and mean percent survival and growth for each species were calculated. Results indicate that autumn olive, elaeagnus cherry, arnot locust, sawtooth oak, red maple, and Toringo crabapple are suitable for quick improvement of surface mine habitat over a wide range of spoil acidity in the Appalachian coalfield. Bessey cherry and European filbert need further study before a decision can be made regarding their reclamation utility. Species that are not recommended for quick habitat improvement over a wide range of surface mine spoil pH conditions include bush honeysuckle, barberry, Siberian crabapple, Manchu cherry, American beautyberry, bear oak, blueberry, rem-red honeysuckle, and redcedar.

14766 **(PB—80-182884) Terrestrial ecological survey of the Elm's Property, St. Mary's County, Maryland. Special report.** Deusen, M.V.; Otto, R.G.; Mount, J.K.; Kaufman, L.S. (Johns Hopkins Univ., Baltimore, MD (USA). Chesapeake Bay Inst.). Apr 1979. 152p. NTIS, PC A08/MF A01.

A terrestrial ecological survey of the Elms Property, St. Mary's County, Maryland was conducted during the 1978 field season. This thousand acre tract is part of the land bank of the Maryland Power Plant Siting Program. Vegetation was surveyed qualitatively to determine plant species present on the site and to identify primary biotopes: ponds, salt marsh, shrub swamp, managed fields and several types of coastal plain forest. Woody vegetation was analyzed semi-quantitatively to identify species assemblages. Soil, topography and water relations were identified as determinants of distributions of vegetative communities. Species composition and basic patterns of distribution and abundance were ascertained for birds, mammals, reptiles and amphibians. No species of threatened or endangered status are believed to inhabit the site.

14767 **(PB—80-189541) Vegetative rehabilitation of arid land disturbed in the development of oil shale and coal. Final report 1975-1978.** McKell, C.M.; Van Epps, G. (Utah State Univ., Logan (USA). Inst. of Land Rehabilitation). Apr 1980. 50p. NTIS, PC A03/MF A01.

Field experiments were established on sites disturbed by exploratory drilling in the oil shale region of northeastern Utah and on disturbed sites on a potential coal mine in south central Utah. Concurrently, greenhouse studies were carried out using soil samples from disturbed sites and processed oil shale. Establishment of container-grown transplants was far more successful than plantings of bare-root seedlings or direct seeding. Early spring planting gave better results than fall planting. Good survival was obtained from summer planting when the soil was moist. Soil surface shaping and application of surface stabilizing materials can be used to collect water runoff and increase plant survival. Propagation of native shrubs from stem cuttings provides a means of multiplying desired biotypes for land rehabilitation. Higher rooting hormone levels are required for some species than are normally used in propagating

cultivated species. The most effective container size and shape for growing transplanting materials is one with adequate volume and ribbed sides to prevent root spiraling.

5106 Regulations

REFER ALSO TO CITATION(S) 13366, 14728, 14729, 14797

14768 (ORNL/EIS—175) Department of Energy Fossil Energy environmental compliance program handbook: Federal regulations on waste disposal. Huffstetler, J.; Collier, B.N.; Brown, K.; McAfee, N. (Oak Ridge National Lab., TN (USA)). Feb 1981. Contract W-7405-ENG-26. 373p. NTIS, PC A16/MF A01.

The US Department of Energy (DOE) is conducting a research, development, and demonstration program to provide technology that will permit rapid commercialization of processes for converting coal into synthetic fuels. This handbook identifies those federal laws and regulations on management of waste disposal that could affect the siting, construction, or operation of a conversion facility. All entries are part of a computerized data base built and maintained for the DOE at Oak Ridge National Laboratory.

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5201 Basic Studies

REFER ALSO TO CITATION(S) 13636, 13641, 14773, 14846

14769 (DOE/EV/10047—2) Data report of the DOE-sponsored Northwest Marine Sciences Group July-August 1979 cruise. Postel, J.R.; Peterson, W.K.; Kitchen, J.C.; Menzies, D.W. (comps.). (Oregon State Univ., Corvallis (USA). School of Oceanography; Washington Univ., Seattle (USA). Dept. of Oceanography; Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1980. Contract AT06-79EV10047. 457p. NTIS, PC A20/MF A01.

This cruise was part of a continuing program to collect detailed information on the processes affecting plankton productivity, abundance, and distribution off the Washington coast, and on the chemistry, distribution, and flux of particulate material in these waters. The sampling program for this cruise was designed to determine the effect of the Quinault Canyon on the biology, chemistry, hydrography, and flux of particulate material in Washington coastal waters. The field program had two major components: Leg I, predominantly a transect or survey phase; and Leg II, intensive sampling at a smaller number of sites to investigate important processes and rates. The transect phase provided an overview of biological and hydrographic parameters over a large region of the coastal zone. The information collected during Leg I provided the bases for selecting sites for intensive sampling on Leg II and also provided a broader geographical data base for interpreting and extrapolating the results of the intensive studies of Leg II. The intensive investigations focused on rates of important processes involved in transfer of energy and biomass in pelagic ecosystems and includes measures of phytoplankton productivity, zooplankton grazing rates, microbial activity, flux of organic matter and suspended particulates, and concentrations of trace metals and hydrocarbons.

14770 (PB—80-174394) An investigation into the chemistry of the uv-ozone purification process. Final report. Leitis, E. (Westgate Research Corp., Los Angeles, CA (USA)). 8 Feb 1980. 219p. NTIS, PC A10/MF A01.

The synergistic effect of ozone and UV light in the decomposition of organic compounds in water is studied. The nature and quantities of oxidation products by ozonation, UV-ozonation, and hydroxyl radical oxidation were assessed to understand the UV-ozonation mechanism. Nitrobenzene was selected as the primary model compound due to its relative resistance to UV-ozonation. This model compound followed an identical sequence of reactions in both O3 and UV/O3 oxidation via mono-, di-, and trihydroxylation of the benzene ring; the major stable intermediates were oxalic acid, formic acid, and glyocal. The ratios of O-, M-, and p-R-phenols produced by ozonation and UV-ozonation of nitrobenzene and chlorobenzene (a secondary model compound) were almost identical and very different from the isomeric phenol ratios given by Fenton's reagent and H2O2/UV systems. Various mono-, di-, tri-, and tetra-substituted benzene derivatives were studied using the oxidation regimes; the kinetics were determined to be pseudo-first order. A hypothesis was advanced that ozone can act also as a nucleophilic reagent towards benzene derivatives with electron withdrawing substituents. The initial work of the pH study has been completed, namely, the effect of very high and very low pH values on the rates of UV-ozonation and ozonation of selected model compounds.

14771 (PB—80-190036) Plankton of the strait of Juan de Fuca, 1976-1977. Final report 1976-77. Chester, A.J.; Damkaer, D.M.; Dey, D.B.; Heron, G.A.; Larrance, J.D. (National Oceanic and Atmospheric Administration, Seattle, WA (USA). Pacific Marine Environmental Lab.). Sep 1979. 75p. NTIS, PC A04/MF A01.

An important aspect of NOAA's Marine Ecosystem Analysis (MESA) Puget Sound Energy-Related Project was to characterize the communities of the inshore marine waters of Washington State. With respect to the plankton, the least known major marine area is the Strait of Juan de Fuca, which separates Puget Sound from the Pacific Ocean. The present study was conducted in the Strait during 1976 and 1977 to describe the seasonal distribution and composition of phytoplankton, zooplankton, and ichthyoplankton populations. This information will add to MESA's overall biological baseline and could aid in monitoring and understanding the effects of possible petroleum discharges associated with increased tanker transport through the Strait of Juan de Fuca.

14772 Flushing model of Onslow Bay, North Carolina, based on intrusion volumes. Atkinson, L.P. (Skidaway Inst. of Oceanography, Savannah GA); Pietrafesa, L.J. *Journal of Physical Oceanography ;* **10**: No. 3, 472-474(Mar 1980).

Onslow Bay, North Carolina, is repeatedly flushed by intrusions of Gulf Stream water. An exponential dilution model based on intrusion models indicates 20 to 60 days are required for 50% dilution of Bay waters.

5202 Chemicals Monitoring And Transport

14773 (DOE/EV/10038—1) Feasibility of large scale deliberate tracer release experiments in or below the oceanic thermocline. Shepherd, J.G.; Broecker, W.S. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Feb 1981. Contract AC02-79EV10038. 60p. NTIS, PC A04/MF A01.

The relative importance of lateral and vertical mixing in the interior of the oceans cannot be reliably determined from conventional oceanographic measurements, nor from observations of fallout radionuclides. It is suggested that the problem could be most effectively studied by an experiment in which a large quantity of a suitable tracer was deliberately released in deep water, and its subsequent dispersion was followed for at least one year. The feasibility of such an experiment is examined. It is concluded that it is indeed feasible, and that helium-3 would be the most suitable tracer, with tritium as a possible alternative. About 30 g f Helium-3 would be needed for each release. Such a quantity may be dissoled in about 1 m^3 of water at pressures greater than 500 dbar, is easily available, and would cost about $100K. Concentrations would have fallen to unmeasurable levels by the time the patch had spread sufficiently to interfere with measurements of natural or radiogenic helium-3. The patch would need to be marked with dusters of neutrally buoyant floats in order that its movement may be followed. It is estimated that it would be around 1000 km across after one year, and anything from a few meters to a few hundred meters thick. Vertically integrating samples would probably be most suitable, used in conjunction with ship-board helium-3 mass spectrometer. Methods of dissolving the helium in situ, and making the release with minimum disturbance are also proposed. The cost would be several million dollars, spread over several years.

14774 **(DOE/EV/10242—1) Natural catalysis of the CO_2-HCO_3^- reaction in surface sea water. Final report.** Broecker, W.S.; Shepherd, J. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Feb 1981. Contract AS02-79EV10242. 4p. NTIS, PC A02/MF A01.

The O_2, CO_2, $^{14}CO_2$ and Rn-222 in large recently collected sea water samples were simultaneously measured. The object was to determine whether the transfer rates for CO_2 or $^{14}CO_2$ were higher than those expected from the O_2 and Rn-222 measurements previously made in ocean surface waters. (ACR)

14775 **(PB—80-175334) Solubility of selected major and minor elements from coal, gob and fly ash accumulations. Completion report, July 1977-September 1979.** Kposick, D.A.; Angino, E.E. (Kansas State Univ., Manhattan (USA). Kansas Water Resources Research Inst.). Mar 1980. 29p. NTIS, PC A03/MF A01.

Nine different fly and bottom ashes, representing four coal producing areas of the United States were used in leaching experiments for Ca, Mg, Na, K, Fe, Mn, Zn, Cu, Pb, and Cd and the potential for contamination of ground and surface water supplied by these elements. Both fly ash and bottom ash are formed by the thermal decomposition or dehydration of inorganic impurities in coal and vary with the type of coal used. Many factors affect leachate characteristics such as coal preparation methods, method and efficiency of combustion, method of disposal, particle morphology, and others.

14776 **(PB—80-176357) Evaluation of chemical agents for inhibiting acid mine drainage formation. Final report.** Nebgen, J.W.; Weatherman, D.F. (Midwest Research Inst., Kansas City, MO (USA)). Apr 1979. 128p. NTIS, PC A07/MF A01.

This report contains findings from a Bureau of Mines study concerning the inhibition of acid mine drainage formation from underground coal mines. A series of experiments was performed in which three different pyritic materials (wastes from coal production plants) were evaluated using several candidate inhibiting agents. Data obtained from the inhibitor-treated pyrites were compared with data from control experiments in which untreated pyritic wastes were used. The experiments were conducted by placing treated and untreated pyrite in columns, passing moist air through the columns to promote oxidation of pyrite, and washing the columns weekly to collect oxidation products for analysis. The results indicate that quantities of acid mine drainage can be substantially reduced if soluble iron III (ferric) ion is controlled.

14777 **(PB—80-178767) A national program for assessing the problem of atmospheric deposition (acid rain). Final report.** Galloway, J.N.; Cowling, E.B.; Gorham, E.; McFee, W.W. (North Carolina State Univ., Raleigh (USA). Agricultural Experiment Station). Dec 1978. 103p. NTIS, PC A06/MF A01.

The objectives of this report are to assess the present scope of available knowledge about atmospheric deposition and its effects on agricultural lands, forests, ranges, parks, surface waters, and aquatic life in the United States and to recommend a coordinated program of research and monitoring necessary to intelligent management of atmospheric emissions and for the amelioration of the adverse effects of atmospheric deposition on plant and animal life.

14778 **(PB—80-199839) Western energy resource development: a network for monitoring the impact on surface water quality. Final report.** Thomas, R.W. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Jul 1980. 109p. NTIS, PC A06/MF A01.

A monitoring network to assess the impact of energy resource development on surface water quality in Western Mountain States is developed. A literature review of energy resource development activities, known and potential pollutants, monitoring strategies, and data requirements for statistical analyses located the river systems most likely to be affected, determined parameters of interest, and identified deficiencies in existing monitoring operations.

14779 **(PB—80-812480) Activated carbon. 1975-1978 (citations from the NTIS Data Base). Report for 1975-78.** Cavagnaro, D.M. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 244p. NTIS PC N01/MF N01.

The bibliography of Federally-funded research cites reports on sewage and industrial waste water treatment using activated carbon. These have been separated from other uses of activated carbon. The first part contains both laboratory as well as engineering studies. The second part covers other reports on activated carbon including research on its properties and its use in air pollution control, gas and water analysis, the absorption of chemicals and radioactive isotopes especially iodine isotopes, and drinking water treatment. (This updated bibliography contains 239 citations, none of which are new entries to the previous edition.)

14780 **Pelagic tar off Georgia and Florida in relation to physical processes.** Cordes, C.; Atkinson, L.; Lee, R.; Blanton, J. (Skidway Inst. of Oceanography, Savannah, GA). *Marine Pollution Bulletin ;* **11**: 315-317(1980).

Following the Ixtoc I oil rig blowout in Campeche Bay we hypothesized that resulting tarballs should eventually appear in the Gulf Stream off Georgia and that because of dynamic barriers in the innershelf little would reach near-shore areas. To test these hypotheses, surface tows to collect floating tar were taken off the coasts of Georgia and Florida in October and December 1979. No tar was found within 40 km of the shore. All samples more than 40 km offshore contained some tar. The mean concentration was 0.82 mg m^{-2} with a range of 0.01 to 5.6 mg m^{-2}. Closely spaced sampling showed extreme variation but trends were consistent. Perylene was the most abundant compound in the tarballs.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 14000, 14762, 14774

14781 **(RFP—3019) History and evaluation of regional radionuclide water monitoring and analysis at the Rocky Flats installation.** Bokowski, D.L.; Henry, R.L.; Hunt, D.C. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 21 Feb 1981. Contract AC04-76DP03533. 22p. NTIS, PC A02/MF A01.

This report provides a frame of reference for evaluating water monitoring data that have been accumulated since the Rocky Flats Plant began operation. Baseline water monitoring indicated that, within the limits of measurement uncertainty, no transuranics were present in area waters prior to the construction of the Plant. A statistical comparison was made of the measured gross alpha and plutonium levels in Great Western Reservoir and in the Broomfield drinking water supplies with levels in other area water bodies and tap waters. All comparisons, with the exception of plutonium in Ralston Reservoir, showed the gross alpha and plutonium activity levels in regional water supplies to be greater than or the same as the levels in the Broomfield tap water or in Great Western Reservoir.

14782 **Evaluation method for closed cycle gas turbines in cogeneration applications.** Daudet, H.C.; Trimble, S.W. (AiRes Manuf Co of Ariz, Phoenix). *American Society of Mechanical Engineers, [Paper] ;* No. 80-GT-176, 1-14(1980).

The utilization of coal-fired closed cycle gas turbine/atmospheric fluidized bed (CCGT/AFB) electrical power generating plants for cogeneration was investigated in a Department of Energy-sponsored study program conducted by The Garrett Corporation. Both industrial process and district heating and cooling applications were considered. 11 refs.

14783 **Foodweb: a model for radioactive transport in the aquatic ecosystem.** Niemczyk, S.J. (Sandia Labs., Albuquerque, NM); Runkle, G.E. *Transactions of the American Nuclear Society ;* **34**: 85-88(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

5204 Thermal Effluents Monitoring And Transport

14784 (NUREG/CR—1044) Threadfin shad impingement; effect of cold stress. Report for 1 Oct 76-30 Sep 78. McLean, R.B.; Singley, P.T.; Griffith, J.S.; McGee, M.V. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract W-7405-ENG-26. 99p. NTIS, PC A05/MF A01.

The objectives of the research were to (1) determine the physical and biological causes of threadfin shad impingement at the Kingston Steam Plant, Watts Bar Reservoir, Tennessee, (2) quantify the effects of impingement on threadfin shad population number and structure, (3) quantify the effects of impingement of threadfin shad on threadfin predators, and (4) determine the feasibility of using blood serum electrolytes to quantify cold stress of shad.

5205 Site Resource And Use Studies

14785 (NUREG/CR—1242) Methods to assess impacts on Hudson River white perch: report for the period October 1, 1978 to September 30, 1979. Barnthouse, L.W.; Kirk, B.L.; Kumar, K.D.; Van Winkle, W.; Vaughan, D.S. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract W-7405-ENG-26. 61p. NTIS, PC A04/MF A01.

This report is a brief description of the work done on the NRC project entitled 'Methods to Assess Impacts on Hudson River White Perch' October 1, 1978 to September 30, 1979. Accounts of special studies of white perch entrainment at Hudson River power plants, of density-dependent growth in the Hudson River white perch population, and of data on the white perch populations of the Delaware and Chesapeake systems were performed. Complete accounts of these special studies are included in this report. During this period, a final draft topical report entitled 'Evaluation of Impingement Losses of White Perch at the Indian Point Nuclear Station and Other Hudson River Power Plants' (NUREG/CR-1100) was completed.

14786 (NUREG/CR—1243) Methods to assess impacts on Hudson River striped bass: report for the period October 1, 1977 to September 30, 1979. Barnthouse, L.W.; Christensen, S.W.; Kirk, B.L.; Kumar, K.D.; Van Winkle, W. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract W-7405-ENG-26. 34p. NTIS, PC A03/MF A01.

The overall objective of this project is to develop and apply quantitative methods for assessing the effects of power plant entrainment and impingement on the Hudson River striped bass population. During the two years covered in this reporting period, our work dealt with five interrelated aspects of this assessment problem: (1) young-of-the year models, (2) mortality of entrained eggs, larvae, and juveniles, (3) projection of long-term impacts using stock recruitment models, (4) relative contribution of the Hudson River stock to the Atlantic coastal striped bass population, and (5) distribution of entrainable striped bass life stages in the immediate vicinity of power plant intakes.

14787 (PB—80-192347) Water for energy development in the Northern Great Plains and Rocky Mountain regions. Staff report. Gray, S.L.; Sparling, E.W.; Whittlesey, N.K. (Economics, Statistics, and Cooperatives Service, Washington, DC (USA). Natural Resource Eonomics Div.). Dec 1979. 135p. NTIS, PC A07/MF A01.

The purpose of this report is to describe water resource use, availability, and potential for satisfying large-scale coal and oil shale developments in the Northern Great Plains and Rocky Mountain Regions of the United States.

14788 (PB—80-204340) Occurrence and activity of iron and sulfur-oxidizing microorganisms in alkaline coal strip mine spoils. Olson, G.J.; McFeters, G.A.; Temple, K.L. (Montana State Univ., Bozeman (USA). Water Resources Research Center). Mar 1980. Contract DI-14-34-0001-9081. 25p. NTIS, PC A02/MF A01.

Spoils samples collected from a coal strip mine in southeastern Montana were examined for populations and activities of iron- and sulfur-oxidizing bacteria. Spoils examined were of three types: (1) acidic pyrite-rich waste coal, (2) oxidation halo material, and (3) alkaline, which was the most widespread type. Bacterial numbers, sulfur oxidation, and $^{14}CO_2$ uptake activity declined to low levels in the summer when spoils were dry. Even in wetter spring months pyritic spoils contained relatively low numbers of acidophilic iron- and sulfur-oxidizing bacteria, probably indicative of water stress since the same spoils incubated with excess water or dilute mineral salts showed considerably greater bacterial numbers and activity. Certain wells in coal and spoils aquifers contained substantial populations of iron-oxidizing acidophilic bacteria. However, these wells were always of alkaline or neutral pH indicating that bacterial pyrite oxidation occurred in localized areas where groundwaters contacted either replaced spoils or coal which contained either pyrite or other metal sulfides. Bacterial activity may contribute to trace metal and sulfate leaching which occur in the area.

5206 Regulations

REFER ALSO TO CITATION(S) 14728, 14729, 14768, 14797

14789 (PB—80-180599) Fisheries management under the Fishery Conservation and Management Act, the Marine Mammal Protection Act, and the Endangered Species Act. Final report. Hammond, K.A.G. (Hammond (Katherine A. Green), Houston, TX (USA)). May 1980. 190p. NTIS, PC A09/MF A01.

The purpose of this report is to determine what steps might be taken to ensure that fishery management plans (FMPs) developed under the Fishery Conservation and Management Act (FCMA) are ecologically sound and fully consistent with the FCMA and with the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). The relevant provisions of the three Acts were examined and four FMPs were reviewed in detail. Persons involved in developing, reviewing and implementing FMPs were interviewed. It appears that FMPs are based primarily on single species rather than ecosystem oriented management concepts, so are not fully consistent with the FCMA, and that FMPs do not effectively incorporate potential impacts on non-target species into determining optimum fishery yields, so are not fully consistent with the FCMA or the ESA. In many cases data are sufficient for developing ecosystem oriented management plans. This report recommends that experts on marine mammals, birds, etc. become involved in FMP drafting, that guidelines for FMP preparation be amended to emphasize impacts on nontarget ecosystem components.

14790 (PB—80-180383) A Mississippi marine finfish management plan. Etzold, D.J.; Christmas, J.Y. (Mississippi-Alabama Sea Grant Consortium, Ocean Springs, MS (USA)). [nd]. 43p. NTIS, PC A03/MF A01.

With increasing fishing pressure on Mississippi Gulf of Mexico finfish resources it is necessary to establish rational procedures for management if optimum yield from these resources is to be achieved. Mississippi Marine Conservation Commission (MMCC) selected spotted seatrout, sand seatrout, red drum, flounder, menhaden, southern kingfish, croaker, mullet, sheepshead, and black drum for consideration in this plan. This summary document lists the goal and objectives of the proposed State plan, and described the following sections. The present State management system is summarized with selected laws and regulations.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

14791 (PB—80-184351) Oil spills: a public official's handbook. Omohundro, J.T. (New York State Coll. of Agriculture and Life Sciences, Ithaca (USA)). Mar 1980. 22p. NTIS, PC A02/MF A01.

This handbook explains the social response to an oil or hazardous substance spill, particularly in water. The reactions of the victims and coastal residents of the impacted area are identified, and actions that may reduce social problems are suggested. The last section, 'Suggestions for Planning and Response,' may be consulted

immediately in the event of a spill. An emergency checklist on the back cover addresses specific actions and guides the reader to appropriate sections of this handbook. The quick reference charts 1, 2, and 3 may serve as memory aids to the social context of particular problems. Officials should find this handbook useful in preparing for public meetings and news conferences, in conducting personal interviews while reconnoitering or administering in the impacted area, and in handling telephone and written requests for information or help.

14792 **(PB—80-192511) Impact mitigation strategy report and an assessment of the economic and fiscal impact of coal development, Allegany and Garrett Counties, Maryland. Final report.** Mallach, A. (Maryland Dept. of Economic and Community Development, Annapolis (USA)). Aug 1979. 228p. NTIS, PC A11/MF A01.

The study attempted to answer a single question: if coal mining activity were to increase significantly during the 1980's, what economic and fiscal effects can be anticipated in Garrett and Allegany Counties. The effects that are the subject of the study are numerous: sections are devoted to economic (income, employment, and economic growth), population (immigration, population increase, and school enrollment increase), housing and fiscal effects (county and municipal revenues and expenditures). In addition, special analyses are presented dealing with the problems of coal haul road maintenance, school facilities, and sewerage treatment capacities.

14793 **(PB—80-198468) Mississippi Deltaic Plain Region ecological characterization: a socioeconomic study. Voume 1: synthesis papers.** Larson, D.K.; Davis, D.W.; Detro, R.A.; Dumond, P.B.; Liebow, E.B. (Willdan Associates, Phoenix, AZ (USA)). Mar 1980. Contract DI-14-16-0009-78-095. 395p. NTIS, PC A17/MF A01.

The Mississippi Deltaic Plain Region extends from Vermilion Bay, Louisiana to the Mississippi-Alabama state line. This study was begun in July 1978 and a full ecological characterization is scheduled for completion in 1981. The overall purpose is to collect, organize and analyze available information from various disciplines (geology, biology, hydrology, socioeconomics, etc.) that will describe each part of the system in terms of its relation to other parts and to the Mississippi Deltaic Plain regional ecosystem as a whole. Socioeconomic characteristics will receive special attention because of extensive oil and gas activities and their impact on the area.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 14349, 14896

14794 **(DOE/EV—0109) Comparing energy technology alternatives from an environmental perspective.** House, P.W.; Coleman, J.A.; Shull, R.D.; Matheny, R.W.; Hock, J.C. (Department of Energy, Washington, DC (USA). Assistant Secretary for Environment). Feb 1981. 73p. NTIS, PC A04/MF A01.

A number of individuals and organizations advocate the use of comparative, formal analysis to determine which are the safest methods for producing and using energy. Some have suggested that the findings of such analyses should be the basis upon which final decisions are made about whether to actually deploy energy technologies. Some of those who support formal comparative analysis are in a position to shape the policy debate on energy and environment. An opposing viewpoint is presented, arguing that for technical reasons, analysis can provide no definitive or rationally credible answers to the question of overall safety. Analysis has not and cannot determine the sum total of damage to human welfare and ecological communities from energy technologies. Analysis has produced estimates of particular types of damage; however, it is impossible to make such estimates comparable and commensurate across different classes of technologies and environmental effects. As a result of the deficiencies, comparative analysis connot form the basis of a credible, viable energy policy. Yet, without formal comparative analysis, how can health, safety, and the natural environment be protected? This paper proposes a method for improving the Nation's approach to this problem. The proposal essentially is that health and the environment should be considered as constraints on the deployment of energy technologies, constraints that are embodied in Government regulations. Whichever technologies can function within these constraints should then compete among themselves. This competition should be based on market factors like cost and efficiency and on political factors like national security and the questions of equity.

14795 **(PB—80-192461) Methodologies to conduct regulatory impact analysis of ambient air quality standards for carbon monoxide. Final report.** Siddiqee, W.; Dermant, A.; Patterson, R. (SRI International, Menlo Park, CA (USA)). Dec 1979. Contract EPA-68-02-2835. 92p. NTIS, PC A05/MF A01.

The report is a summary of a methodology developed to analyze mobile source emission reductions needed to attain alternative proposed national ambient air quality standards for carbon monoxide. A costing routine is part of the procedure. The methodology was used in the carbon monoxide regulatory impact analysis for alternative national air standards.

14796 **(PB—80-196264) Environmental system study on the development of fossil fuel resources in the southwest. Summary report.** Sawyer, J.W. Jr. (New Mexico Univ., Albuquerque (USA). Dept. of Economics). Aug 1977. 16p. NTIS, PC A02/MF A01.

Alternative technologies currently or potentially available for producing energy and synthetic fuels from coal and oil shale in the Southwest are described.

14797 **(PB—80-197916) Environmental assessment data systems: terminology reference manual. Final report May-November 79.** Larkin, R.J.; Ballard, B. (Acurex Corp., Mountain View, CA (USA)). Feb 1980. Contract EPA-68-02-2699. 225p. NTIS, PC A10/MF A01.

The report is a general reference manual on the terminology used to enter and retrieve information from the Environmental Assessment Data Systems (EADS), a group of interrelated computerized data bases that describe multimedia discharges from energy systems and industrial processes. The EADS was designed to aid researchers in environmental assessment, source characterization, and control technology development. The report contains the standard nomenclature or terminology used to describe certain data categories in the waste stream data bases. To selectively retrieve data from the waste stream data bases, consistent terminology must be used if the computer search is to obtain an exact match. The report contains terminology to be used to categorize sources, describe control technology, identify chemical compounds and elements, describe analytical methods in sample analysis, and list other data. The terminology applies to particle, gas, liquid, and solid discharge effluent streams.

5303 Environmental Impact Statements

14798 **(OCS—56(Vol.1)) Final environmental impact statement. Proposed 1981 Outer Continental Shelf oil and gas lease Sale 56.** (Bureau of Land Management, New Orleans, LA (USA). New Orleans Outer Continental Shelf Office). Jan 1981. 683p. Department of the Interior, New Orleans, LA.

The purpose of this final environmental impact statement (FEIS) for proposed Outer Continental Shelf (OCS) Sale 56 is to revise the draft environmental impact statement (DEIS) prepared for this proposed sale which was made available to the public on July 10, 1980. To aid the reader, a summary description is given of the proposed action, scoping process, alternatives and environmental consequences which are described in the EIS. Section V lists the agencies with whom coordination has been held in the development of the DEIS, comments received in response to the DEIS, and responses thereto. Proposed OCS Sale 56 is scheduled for August 1981 as the seventh sale of the 5-Year Leasing Program. It would be the second OCS oil/gas lease sale held in the South Atlantic offshore region. The sale consists of 658,944 hectares (1,628,251 acres) offshore the states of North Carolina, South Carolina, Georgia, and Florida in 286 tracts located from 16 to 111 nau-

tical miles from shore in water from 20 to 2100 meters deep. The US Geological Survey (GS) has estimated that there are 1.4 billion barrels of oil and 2.5 trillion cubic feet of natural gas in the leasing area (conditional probability mean estimate) and that total development of these resources will require 101 exploratory wells, 56 production platforms, and 1299 development wells. It is assumed under the mean resource estimate development scenarios that oil and gas production will be gathered from offshore production areas and transported to shore through pipelines. Additional assumptions include the use of 2 to 7 temporary and 2 to 8 permanent service bases and the construction of up to 2 marine terminals and gas processing plants. Environmental impacts of four alternatives, including the proposed action, are presented.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

14799 **System for recording and processing taxonomic data.** Kuhn, D.L.; Plafkin, J.L.; Cairns, J. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Water Resources Bulletin ;* **14**: No. 6, 1507-1509(Dec 1978).

A system in which taxonomic information is recorded in a form that can be directly utilized by computer is described. How such a system can greatly facilitate the acquisition and analysis of data is also discussed.

14800 **Consolidating taxonomic information into a working library.** Kuhn, D.L.; Plafkin, J.L.; Cairns, J. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg). *Transactions of the American Microscopical Society ;* **97**: No. 3, 417-418(Jul 1978).

Most taxonomists find it necessary to accumulate an extensive library which is likely to include a wide variety of materials such as journal publications, hard cover texts, personal sketches and notes, keys, photomicrographs, etc. All these materials can be manipulated and consolidated into a personalized, functional format by use of the microfiche system described here.

5501 Behavioral Biology

14801 **Behavioral implications of mechanistic ecology II: the African rainbow lizard, Agama agama.** Porter, W.P.; James, F.C. (Univ. of Wisconsin, Madison). *Copeia ;* **4**: 574-619(1979).

The daily and seasonal activity of the African rainbow lizard, Agama agama is predicted in terms of heat transfer models for the microenvironment and the lizard. The models, originally developed for the temperate Mohave Desert and for the desert iguana, Dipsosaurus dorsalis, have been refined and are applicable to a tropical area and a tropical species. Field microclimate measurements and observations of lizard activity and food consumption by different sizes of lizards are consistent with these models. Environmental constraints on activity times, sun vs shade locations, height above the ground and postures are described. The sensitivity of the metabolic predictions to different maximum temperature preferences and behavioral options are discussed. The balance between maintenance energy savings via lower thermoregulatory temperatures and time available in different parts of the microenvironment are examined. A simple predator-prey interaction illustrates the substantial effect of climate in modifying amount of time both prey and predator would be expected to be active simultaneously in the tropics vs a temperate desert. Comparisons are made between A. agama and the desert iguana, D. dorsalis for daily and seasonal maintenance requirements and their implications for seasonal changes in growth and reproductive potential.

14802 **Stability and return times of Leslie matrices with density-dependent survival: applications to fish populations.** Deangelis, D.L.; Svoboda, L.J.; Christensen, S.W.; Vaughan, D.S. (Oak Ridge National Lab., TN). *Ecological Modelling ;* **8**: 149-163(1980).

A Leslie matrix population model is used to predict the stability and times of return to equilibrium of fish populations following perturbations. The model is compensatory, having density dependence in the young-of-the-year (y-o-y) survival term. We first present conditions under which a unique equilibrium point exists for a population. Then, through stability analysis, we derive conditions that the y-o-y survival function must satisfy for stability to be assured. It is demonstrated that the dominant eigenvalue of the linearized Leslie matrix can be used to calculate, to good approximation, the time of return to equilibrium of the population following a perturbation. The return times of five model fish populations are compared over a range of assumed strengths of the compensatory mechanism. The model of the Hudson River striped bass population, in which the peak egg contribution occurs in age class 7, has a slower return time than that of an Atlantic menhaden population, where the peak egg contribution is in age class 2.

14803 **Testing a simulation model for reconstruction of prehistoric forest-stand dynamics.** Solomon, A.M.; Delcourt, H.R.; West, D.C.; Blasing, T.J. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Quaternary Research (New York) ;* **14**: 275-293(1980).

Three characteristics of the output of a forest-stand simulation model were matched to pollen records of actual vegetation in central Tennessee. Temporal shifts of individual pollen taxon frequencies were compared to shifts of individual plant species frequencies in simulated biomass for the last 16,000 y. Individual pollen profiles (temporally ordered species frequencies) were also compared to simulated biomass profiles during that period. Modern ratios of pollen to vegetation composition (R values) were compared with those calculated from simulated biomass percentages and fossil pollen percentages. The model output was similar to the comparable characteristics of the pollen record. The model output is therefore a plausible description of vegetation characteristics at the site of pollen deposition in central Tennessee. The model produced information unavailable from other sets of prehistoric data. This information describes the invasion and growth of the yellow-poplar which produces no windborne pollen, and of palynologically indistinguishable oak and pine species. These results suggest that many paleoecological questions can be answered through appropriate simulation modeling studies.

14804 **Cannibalism and size dispersal in young-of-the-year largemouth bass: experiment and model.** Deangelis, D.L.; Cox, D.K.; Coutant, C.C. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Ecological Modelling ;* **8**: 133-148(1979).

A mathematical model for the dynamics of a population of young-of-the-year largemouth bass was formulated on the basis of laboratory experiments. The model was used to make a tentative test of the hypothesis that differing availbilities of alternative foods are decisive in determining the rates of cannibalism and, hence, differences in the observed behavior of the laboratory populations. It was found that slight differences in the degree of dispersal of initial sizes of individuals were probably more important in influencing the population dynamics than alternative food availability or other factors. The model was then compared with data on largemouth bass growth from pond experiments, which showed that, with some modifications of parameter values, the model is also capable of describing the young-of-the-year population dynamics in a pond.

5502 Biochemistry

REFER ALSO TO CITATION(S) 13568, 14828, 14829, 14833, 14838, 14840, 14841, 14842, 14901

14805 **Determination of the triplet and excited singlet absorption spectra of chlorophyll a with a tunable dye laser.** Baugher, J.; Hindman, J.C.; Katz, J.J. (Argonne National Lab., IL). *Chemical Physics Letters ;* **63**: No. 1, 159-162(1 May 1979).

A tunable dye laser has been used to obtain the optical spectra of the triplet and first excited singlet states of chlorophyll a in pyridine produced by irradiation with a nitrogen laser. The singlet spectrum is characterized by an absorption at 440 nm.

14806 (COO—2783-5) Physiopathology of blood platelets: a model system for studies of cell-to-cell interaction. Progress report, November 1, 1979-October 31, 1980. (Memorial Hospital, Pawtucket, RI (USA)). 1980. Contract AS02-76EV02783. 34p. NTIS, PC A03/MF A01.

This report covers the studies on basic mechanisms of cellular interactions, utilizing platelets as a model system and, when possible, concentrating on the influence that environmental factors (nutritional, metabolic, cellular, immunologic and others) have on them. The four major sections include: platelet interaction with tumor cells; a model for the study of cell-to-cell interaction; interaction of platelets with vessel walls; and platelet interactions with immune proteins.

14807 Quantitative evaluation of γ-turn conformation in proline-containing peptides using ^{13}C N.M.R. London, R.E. (Los Alamos Scientific Lab., NM). *International Journal of Peptide and Protein Research ;* **14**: 377-387(1979).

The dependence of the ^{13}C shift difference of proline carbons C/sub β/ and C/sub γ/ on the dihedral angle psi has been studied using the model peptide acetyl-D-proline N-methylamide. The shift difference Δ/sub βγ/ is shown to be correlated with the percent cis isomer about the acetylproline bond, both factors depending strongly on the degree of intermolecular hydrogen bonding. Both the fraction of trans peptide bond and the fractional γ-turn conformation increase as the sample concentration is decreased in $CDCl_3$. Δ/sub βγ/ values have been used to evaluate the fractional γ-turn probabilities in a number of cyclic and linear peptides including thyrotropin releasing factor and bradykinin. Using this parameter, it is concluded that in bradykinin the γ-turn probability is low in D_2O and not strongly temperature dependent. In contrast, studies of a model peptide for the portion of bradykinin believed to adopt a γ-turn conformation are consistent with an increased γ-turn probability in less polar solvents. Data for X-Pro-Y peptides (Y = imino acid) indicate significantly reduced values of Δ/sub βγ/, and this appears to be a useful basis for assigning the Pro C/sub β/ resonances corresponding to this sequence.

14808 Kinetics of the oxyhydrogen reaction in the presence and absence of carbon dioxide in Scenedesmus obliquus. Erbes, D.L.; Gibbs, M. (Brandeis Univ., Waltham, MA). Contract AC02-76ER03231. *Plant Physiology ;* **67**: No. 1, 129-132(Jan 1981).

The oxyhydrogen reaction in the presence and absence of CO_2 was studied in H_2-adapted Scenedesmus obliquus by monitoring the initial rates of H_2, O_2, and $^{14}CO_2$ uptake and the effect of inhibitors on these rates with gas-sensing electrodes and isotopic techniques. In the presence of 0.02 atmosphere O_2, the pH_2 was varied from 0 to 1 atmosphere. Whereas the rate of O_2 uptake increased by only 30%, the rate of H_2 uptake increased severalfold over the range of pH_2 values. At 0.1 atmosphere H_2 and 0.02 atmosphere O_2, rates for H_2 and O_2 uptake were between 15 and 25 micromoles per milligram chlorophyll per hour. As the pH_2 was changed from 0 to 1 atmosphere, the quotient H_2:O_2 changed from 0 to roughly 2. This change may reflect the competition between H_2 and the endogenous respiratory electron donors. Respiration in the presence of glucose and acetate was also competitive with H_2 uptake. KCN inhibited equally respiration (O_2 uptake in the absence of H_2) and the oxyhydrogen reaction in the presence and absence of CO_2. The uncoupler carbonyl cyanide p-trifluoromethoxyphenylhydrazone accelerated the rate of respiration and the oxyhydrogen reaction to a similar extent. It was concluded that the oxyhydrogen reaction both in the presence and absence of CO_2 has properties in common with components of respiration and photosynthesis. Participation of these two processes in the oxyhydrogen reaction would require a closely linked shuttle between mitochondrion and chloroplast.

14809 Active site structure of bacteriorhodopsin and mechanism of action. Crespi, H.L.; Ferraro, J.R. (Argonne National Lab., IL). *Biochemical and Biophysical Research Communications ;* **91**: No. 2, 575-582(28 Nov 1979).

Pressure experiments with freeze-dried bacteriorhodopsin indicate that water is an essential part of the chromophore. This observation is combined with already known information on (a) the pH dependence of proton pumping, (b) the secondary protein-chromophore interaction with lysine-40, and (c) the proton transfer in the initial photochemical step to give a detailed structure of the active site and a mechanism for proton pumping which is consistent with the bacteriorhodopsin polypeptide sequence.

14810 Kinetics of initiation of bacterial protein synthesis. Blumberg, B.M. (Univ. of Chicago, IL); Nakamoto, T.; Kezdy, F.J. Contract EY-76-C-02-0069. *Proceedings of the National Academy of Sciences of the United States of America ;* **76**: No. 1, 251-255(Jan 1979).

The 30S initiation complex, formed with the 30S ribosomal subunit, mRNA, and fMet-tRNA, has been shown by kinetic analysis with limiting concentrations of Escherichia coli ribosomes to be an obligatory intermediate in the formation of the 70S initiation complex. The formation of the 70S initiation complex began with an induction period and was proportional to the concentration of the 30S complex, which rapidly rose to a peak. The entire time course of the sequential pseudo-first-order, second-order reaction was reproduced accurately by the overall rate expression, in which we used rate constants that were determined by carrying out 30S and 70S complex formation separately. By using limiting concentrations of mRNA, we showed that phage MS2 RNA contained no specific signal that enhanced its rate of 30S complex formation with E. coli ribosomes and initiation factors; the pseudo-first-order rate constants obtained with $poly(A_3C_6G_1U_1)$, $poly(C_{15}G_1U_4)$, and $poly(G_1U_3)$ were 12 to 45 times higher than that with MS2 RNA. The observation that the rate constants for binding of fMet-tRNA and AcPhe-tRNA with a given synthetic RNA were comparable indicated that the initiator codon is recognized only indirectly through the initiator tRNA.

14811 Intramolecular electron transfer and binding constants in iron hexacyanide-cytochrome c complexes as studied by pulse radiolysis. Ilan, Y. (Hebrew Univ., Jerusalem, Israel); Shafferman, A. Contract E(11-1)-3009; E(11-1)-3221. *Biochimica et Biophysica Acta ;* **548**: 161-165(1979).

Internal oxidation and reduction rates of horse cytochrome c in the complexes CII.Fe(III)$(CN_6)^{3-}$ and CIII.Fe(II)$(CN)_6^{4-}$, are $4.6.10^4 s^{-1}$ and $3.3.10^2 s^{-1}$, respectively. The binding site of the iron hexacyanide ions on either CII or CIII are kinetically almost indistinguishable; binding constants range from $0.87.10^3$ to $2.10^3 M^{-1}$. The present pulse radiolytic kinetic data is compared with that from NMR, T-jump and equilibrium dialysis studies.

14812 Mechanism of mobilization of bone mineral by 1,25-dihydroxyvitamin D_3. Brommage, R.; Neuman, W.F. (Univ. of Rochester, NY). *American Journal of Physiology, The ;* **237**: No. 2, E113-E120(1979).

To better understand the mechanism(s) by which 1,25-dihydroxyvitamin D_3($1,25(OH)_2D_3$ promotes the mobilization of bone mineral, calvarial lactate production, and mineral solubility were studied in an in vitro incubation system. The calvairae were obtained from neonatal mice, some of which were previously injected with 20 ng of $1,25(OH)_2D_3$. In live bones $1,25(OH)_2D_3$ mobilized bone mineral as evidenced by the increased release of both calcium and phosphate into the medium throughout 48 h of incubation. When examined as a function of incubation time and the interval between injection and incubation, $1,25(OH)_2D_3$ did not affect lactate production. Apparently, $1,25(OH)_2D_3$ does not mobilize skeletal mineral through a lactate-mediated pH gradient mechanism. Over 4 days of incubation, $1,25(OH)_2D_3$-treated calvariae supported higher buffer levels of calcium and phosphate in the absence of cellular metabolism, indicating the solubility of bone mineral was increased by $1,25(OH)_2D_3$ treatment. Because the effects of $1,25(OH)_2D_3$ were observed in nonvital bone, a pump mechanism cannot fully explain the $1,25(OH)_2D_3$-induced transfer of calcium and phosphate from bone to blood. These findings suggest that a mechanism involving an increase in bone mineral solubility, presumably mediated through a mineral solubilizer(s), is at least partially responsible for the skeletal actions of $1,25(OH)_2D_3$.

14813 Mass-spectral identification and purification of phycoerythrobilin and phycocyanobilin. Fu, E.; Friedman, L.; Siegelman, H.W. (Brookhaven National Lab., Upton, NY). *Biochemical Journal ;* **179**: 1-6(1979).

The bile-pigment chromophores of C-phycoerythrin (phycoerythrobilin) and C-phycocyanin (phycocyanobilin) were cleaved

from their respective proteins with boiling methanol or butan-1-ol. They were purified as dicarboxylic acids by preparative reverse-phase liquid chromatography. Each pigment existed in two principal forms, which were characterized by using 20 pmol samples by proton-transfer chemical-ionization mass spectroscopy. These two principal forms were isomeric species, and all had protonated parent molecular ions with m/e 587, corresponding to a molecular weight of 586.

14814 **Chlorophyll-lipid interactions.** Katz, J.J. (Argonne National Lab., IL). pp 37-56 of Advances in the biochemistry and physiology of plant lipids. Appelqvist, L.A.; Liljenberg, C. (eds.). Amsterdam, Netherlands; Elsevier/North-Holland Biomedical Press (1979).

The chlorophyll molecule is in a sense a surfactant by virtue of its polar macrocycle and its long, nonpolar, esterifying alcohol. Some properties of chlorophyll that derive from its lipid moiety are described. Chlorophyll may also interact with the lipid components of the photosynthetic membrane by coordination interactions involving the central magnesium atom of the chlorophyll and nucleophilic groups present in the lipids. Proton magnetic resonance has been used to explore possible coordination interations between chlorophyll and galactolipids and between chlorophyll and xanthophylls. As reasonably detailed models of both photo-reaction center chlorophyll and green plant antenna chlorophyll have been developed recently, various ways in which these can be incorporated into the photosynthetic membrane are examined.

14815 **Ionophores and ion transport across natural membranes.** Shamoo, A.E.; Murphy, T.J. (Univ. of Rochester School of Medicine and Dentistry, NY). *Current Topics in Bioenergetics ;* **9**: 147-177(1979).

The identification of ion transport site (ionophore) and the ATP hydrolytic enzyme provide the best lead yet to the study of the mechanism of energy transduction. It could provide the means by which one can study the spatial relationship between the ATP hydrolytic site and the ion transport site and correlate this with the functional state of the enzyme. It would be very useful if a system were developed whereby one could control the state of phosphorylation and dephosphorylation of the enzyme to study the relationship between the ionophoric and ATP hydrolytic sites under such controlled states.

14816 **Characterization of the flow dynamics of an enzyme reaction system.** Pomernacki, C.L.; Brubaker, T.A.; Brand, H.R.; Frazer, J.W. (Lawrence Livermore Lab., CA). Contract W-7405-ENG-48. *Analytica Chimica Acta ;* **112**: 287-295(1979).

The characterization of the flow dynamics of an automated enzyme reaction system is discussed. Parametric and non-parametric characterizations are constructed and then tested against actual experiments. The analytical model provides a more compact representation than the numerical model. A second-order lag-plus-dead-time model gives a good fit to the experimental data.

14817 **Energy transduction between the catalytic and ionophoric sites of Ca^{2+} + Mg^{2+}-ATPase molecule.** Shamoo, A.E.; Herrmann, T.; Abramson, J.J.; Murphy, T. (Univ. of Rochester, NY). pp 91-99 of Function and molecular aspects of biomembrane transport. Quagliariello, E. (ed.). Amsterdam, Netherlands; Elsevier/North-Holland Biomedical Press (1979).

Our data have shown that the intact sarcoplasmic reticulum (SR) Ca^{2+} + Mg^{2+}-ATPase molecule contains the Ca^{2+}-conducting pathway (Ca^{2+}-ionophorous property) as an integral part of the enzyme molecule. Furthermore, we have shown that controlled tryptic digestion of the enzyme results first in the production of 55,000 (A) and 45,000 (B) dalton fragments followed by a further cleavage of the 55K fragment into 30,000 (A_1) and 20,000 (A_2) dalton fragments. Digestion of the 55K dalton fragment into 20K and 30K dalton fragments results in inhibition of calcium transport in SR vesicles, but does not affect ATPase activity. This is consistent with disruption of energy transduction between the hydrolytic site (30K) and the ionophoric site (20K). It was also shown that the 55K (A_1) and 20K (A_2) have ionophorous activity similar to that of the intact enzyme, and that the 45K dalton fragment has nonselective channel-like activity. The 20K (A_2) fragment possesses Ca^{2+} ionophorous properties in phosphatidylcholine vesicles similar to those observed in black lipid membranes. Also, it is shown that a cyanogen bromide cleavage fragment (13,000 daltons) of the 20K fragment contains the viable Ca^{2+}-ionophore. A model relating the structure-function relationship of the various sites of action in Ca^{2+} + MG^{2+}-ATPase molecule is presented.

14818 **Effects of stem girdling on biogeochemical cycles within a mixed deciduous forest in Eastern Tennessee. II. Soil nitrogen mineralization and nitrification rates.** Johnson, D.W.; Edwards, N.T. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Oecologia (Berlin) ;* **40**: 259-271(1979).

Nitrogen mineralization and net nitrification rates were 3 to 7 times greater in soil incubations from a girdled Liriodendron tulipifera (L.) stand than in a control stand. Neither litter nor root extracts had an inhibitory effect on nitrogen mineralization or nitrification rate. A lack of nitrification inhibitors also was demonstrated by the fact that ammonium added to the control stand was completely converted to nitrate upon incubation. Additions of sucrose increased CO_2 evolution and decreased nitrogen mineralization and nitrification rates in the girdled plot soil, suggeting that nitrification could be effectively controlled by competition for NH_4^+ supplies by heterotrophic soil organisms. CO_2 evolution rates during incubation showed that heterotrophic as well as nitrifier activities were greater in the girdled plot soil than in the ungirdled plot soil, but the ratio of C to N mineralized was lower in the girdled plot soil. These results collectively indicate that nitrification is regulated by the availability of NH_4^+ in these stands, and that the latter is strongly regulated by heterotrophic demand for N.

14819 **Potassium, sodium, and the intracellular fluid space of cells from bone.** Brand, J.S.; Cushing, J.; Hefley, T. (Univ. of Rochester, NY). *Calcified Tissue International ;* **29**: 119-125(1979).

Cell enzymatically dispersed from fetal rat calvaria were analyzed for sodium and potassium content and intracellular fluid space (ICF). Even when obtained in comparatively high yield, the cells are damaged by the isolation procedure as evidenced by high sodium and low potassium content immediately after isolation. During a post-incubation period potassium is accumulated and sodium extruded to steady-state levels. Although electrolyte content of cells after recovery did not vary as a function of cell yield, ICF was increased in cells obtained in lower yield, suggesting cell swelling as a result of membrane damage. The weighted mean values obtained for the best cell preparation were 117 mM K^+ and 27 mM Na^+. Based on DNA assay of isolated cells and the whole tissue, 20- to 21-day calvaria were found to have an average of 8.1 x 10^6 cells/calvarium. Combining cell data with analysis of total tissue sodium, potassium, and water, it was concluded that the tissue extracellular sodium is in equilibrium with blood but that the potassium concentration is approximately 5-fold higher than blood levels.

14820 **Importance of symmetry and conformational flexibility in DNA structure for understanding protein-DNA interactions.** Sobell, H.M. (Univ. of Rochester, NY). pp 171-199 of Biological regulation and development. Vol. 1. Goldberger, R.F. (ed.). New York, NY; Plenum Publishing Corp. (1979).

During the past few years, there has been a growing realization that two aspects of DNA structure, namely, its symmetry and its conformational flexibility, play important roles in protein-DNA interactions involved in genetic regulation. This chapter reviews evidence along these lines, beginning with our structural studies of drug intercalation (these studies have given direct structural information concerning the roles of symmetry and conformational flexibility in DNA structure in a variety of drug-DNA interactions), enlarging on this theme with a discussion of the nature of DNA breathing and DNA denaturation, and ending with discussions of specific protein - DNA interactions that involve various aspects of DNA symmetry and flexibility - that is histone-DNA interactions in chromatin, RNA polymerase-promoter recognition, operator-repressor recognition, and so on.

14821 **Chromosome abnormalities in leukemia.** Rowley, J.D. (Univ. of Chicago, IL). Contract EY-76-C-02-0069. pp 43-52 of Modern trends in human leukemia. III. Newest results in clinical and biological research. Neth, R.; Gallo, R.C.; Hofschneider, P.H.; Mannweiler, K. New York, NY; Springer-Verlag (1979).

The renewed interest in the study of chromosome abnormalities in hematologic malignancies, particularly in the leukemias, is the result of technical improvements which permit the precise identification of each human chromosome, and of parts of chromosomes as well. The infomation obtained raises a number of questions regarding the validity of older notions, such as the variability of the chromosome pattern (karyotype) in acute leukemia, or the rarity of associations of specific chromosome abnormalities with particular types of leukemia. One of the surprising observations of the last few years has been the frequent occurrence of consistent translocations in a variety of hematologic malignancies. The challenging questions at present are how and why nonrandom changes, particularly consistent translocations, occur.

14822 **Enzymatic determinants of DNA polymerase accuracy. Theory of coliphage T4 polymerase mechanisms.** Galas, D.J.; Branscomb, E.W. (Lawrence Livermore Lab., CA). Contract W-7405-ENG-48. *Journal of Molecular Biology ;* **124**: 653-687(1978).

The specificity of base selection in DNA synthesis is affected by the DNA polymerase. This paper presents a detailed model of the enzymatic reaction steps involved in template-directed DNA synthesis by DNA polymerase possessing 3′ to 5′ exonuclease activity (the T4 coliphage enzyme and polymerases I, II and III of Escherichia coli are known examples). The central assumptions of the model imply that the strength of the hydrogen bonds formed between candidate bases and the template base provide the principal discrimination criteria for both the insertion and the editing excision of bases. We have performed a detailed analysis of this model, and of the stochastic, sequential, single-step process of insertion and excision, which it implies, and have compared the results with experimental data reported by Bessman et al. (1974a,b) for the DNA polymerase of T4. In the present version of the model, the presence of the editing exonuclease accounts for the enzyme's contribution to the accuracy of polymerization and all binding and reaction sites on the enzyme are insensitive to differences between bases or base-pairs. The Bessman data, describing the competitive incorporation of adenine and 2-aminopurine by five allelic polymerases and spanning a spectrum of mutation rates, are well fit by this theory, and permit us to predict the effects of changes in reaction conditions and in base-pairing free energy on the outcome of similar experiments.

5503 Cytology

14823 **Alkaline phosphatase and an acid arylamidase as marker enzymes for normal and transformed WI-38 cells.** Dolbeare, F.; Vanderlaan, M.; Phares, W. (Univ. of California, Livermore). Contract W-7405-ENG-48. *Journal of Histochemistry and Cytochemistry, The ;* **28**: No. 5, 419-426(1980).

A survey of eleven enzyme activity levels in normal and SV40 transformed (VA-13) WI-38 cells revealed that the transformed cell enzymes differed by a quantitative and qualitative change of alkaline phosphatase and a quantitative loss of an arylamidase. Alkaline phosphatase activity was found to be elevated in the transformed cells at confluency but not in log phase cultures. While the arylamidase activity from both normal and transformed WI-38 cells had identical pH optima and K/sub m/ values, the activity was approximately 20 times higher in confluent WI-38 cells than in confluent VA-13 cells. Cytochemical staining techniques for both activities are described that permit identification of fluorescent product within the cells, analysis of activity levels, and separation of cells with high and low activities. Mixtures of WI-38 cells and VA-13 cells separated by flow cytometry on the basis of arylamidase activity were subsequently evaluated for alkaline phosphatase isoenzyme and found to have been simultaneously separated into heat labile and heat stable samples.

14824 **Further evidence of the in vivo role of erythropoietin or companion molecules induced by hypoxia on proliferation and continuing differentiation of BFU-e in PCDC.** Harigaya, K.; Cronkite, E.P.; Miller, M.E.; Moccia, G. (Brookhaven National Lab., Upton, NY). Contract AC02-76CH00016. *Blood ;* **57**: No. 2, 298-304(Feb 1981).

Normal and plethoric bone marrow cells were grown in plasma clot diffusion chambers (PCDC) implanted into the peritoneum of normal mice or mice submitted to 7 h of hypoxia (23,000 ft) daily, on a single day or on 2 consecutive days at different times after implantation of the PCDC's. Daily discontinuous hypoxia (DDH) produced more 6-day bursts than other treatments. Hypoxia on days 1 and 2 after implantation was nearly as effective as DDH on day-6 bursts. Erythropoietin (Ep) levels were measured by bioassay on both diffusion chamber (DC) contents and serum. Serum Ep levels peaked after a 7-hr hypoxic exposure while the DC content Ep levels were in the nondetectable range. The data implies that either higher than normal Ep levels or a companion molecule(s) produced by hypoxia are required for 1 to 2 days early in the culture period to force an increasing number of BFU-d-e down the erythrocytic pathway and thus increase red cell production at times of need in vivo.

5504 Genetics

REFER ALSO TO CITATION(S) 14763, 14821, 14890

14825 **Number of evolutionary trees.** Felsenstein, J. Contract AT06-76EV71005. *Systematic Zoology ;* **27**: No. 1, 27-33(Mar 1978).

A simple method of counting the number of possible evolutionary trees is presented. The trees are assumed to be rooted, with labelled tips but unlabelled root and unlabelled interior nodes. The method allows multifurcations as well as bifurcations. It makes use of a simple recurrence relation for T(n,m), the number of trees with n labelled tips and m unlabelled interior nodes. A table of the total number of trees is presented up to n = 22. There are 282,137,824 different trees having 10 tip species, and over 8.87×10^{23} different trees having 20 tip species. The method is extended to count trees some of whose interior nodes may be labelled. The principal uses of these numbers will be to double-check algorithms and notation systems, and to frighten taxonomists.

5505 Metabolism

14826 **Temporal compartmentation in Lemna paucicostata: photoperiodism, respiration, nitrogen nutrition and heterotrophic growth of different strains.** Hillman, W.S. (Brookhaven National Lab., Upton, NY). *American Journal of Botany ;* **66**: No. 9, 1021-1028(1979).

In previous work with strain 6746 of Lemna paucicostata Hegelm. in heterotrophic culture, changes in the light schedule affected certain features of the daily respiratory pattern, on some but not all nitrogen sources, in a manner paralleling their effects on timing in the photoperiodic flowering response. Seeking further guidance on which metabolic processes should be investigated to understand this relationship, twelve additional strains were compared with 6746 in regard to (1) heterotrophic flowering under short-day skeleton photoperiods, and (2) daily respiratory patterns under 0.25 hr daily of dim red light. Heterotrophic flowering occurred in eight strains; among these, several differed sharply from 6746 in the character of their respiratory patterns and the probable relation of those patterns to photoperiodic timing. For example, in 6746, the second daily peak on NO_3, NH_4 and probably on glutamine reflects photoperiodic timing; the patterns on N-deficient, aspartate and glutamate media do not. In strains 6609 and 381, in contrast, glutamate also elicits a second peak probably reflective of photoperiodic timing; in strain 421, neither the NO_3 nor NH_4 patterns resemble those reflecting photoperiodic timing in 6746. Other strain differences in flowering, respiratory patterns and heterotrophic growth provide useful material for studying phytochrome action, N assimilation and respiration, and they confirm the view that strain identity may be crucial in biochemical investigations on Lemnaceae. These results also reinforce the concept that the temporal compartmentation of systems entrained to light/dark cycles

can provide important insights, and should be more widely used, in work on regulation of plant metabolism.

14827 **Chamber for in situ evaluations of periphyton productivity in lotic systems.** Rodgers, J.H. Jr.; Dickson, K.L.; Cairns, J. Jr. *Archiv fuer Hydrobiologie ;* **84**: No. 3, 389-398(Nov 1978).

A test chamber for in situ measurement of primary productivity using ^{14}C uptake and other functions of periphyton in lotic systems is described. The chamber incorporates an internal variable-speed pump to insure mixing and is constructed of sturdy inexpensive materials. The structural and operational characteristics (light transmittance and absorption, flow rates and turnover times, etc.) are reported. Field and laboratory testing of the chamber was conducted which demonstrated the efficacy of the chamber in evaluating some functional activities of periphyton.

5506 Medicine

14828 **(DOE/EV/10356—1) Studies of the biochemical regulation of blood cell formation. Final report, January 1-September 30, 1980.** Goldwasser, E. (Chicago Univ., IL (USA). Dept. of Biochemistry). Sep 1980. Contract AC02-80EV10356. 5p. NTIS, PC A02/MF A01.

This final report summarizes our most recent experimentation on the mechanism by which the erythropoietin interaction with cell surface receptors initiates nuclear RNA synthesis. It also describes the biological and biochemical effects of endotoxin-free erythropoietin, the finding that maximal hemoglobin synthesis in semi-solid medium probably requires cell-cell interactions and the initial clinical testing of erythropoietin in patients with anemia due to chronic renal disease.

14829 **(PB—80-175268) Biomedical research, development, and engineering at the Johns Hopkins University Applied Physics Laboratory. Annual report 1 October 1978-30 September 1979.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). Oct 1979. 74p. NTIS, PC A04/MF A01.

The Medical Institutions of The Johns Hopkins University and The Johns Hopkins University Applied Physics Laboratory have developed a vigorous collaborative program of biomedical research, development, and systems engineering. An important objective of the program is to apply the expertise in engineering, the physical sciences, and systems analysis acquired by APL in defense and space research and development to problems of medical research and health care delivery. This program has grown to include collaboration with many of the clinical and basic science departments of the medical divisions. Active collaborative projects exist in ophthalmology, neurosensory research and instrumentation development, cardiovascular systems, patient monitoring, therapeutic and rehabilitation systems, clinical information systems, and clinical engineering. This application of state-of-the-art technology has contributed to advances in many areas of basic medical research and in clinical diagnosis and therapy through improvement of instrumentation, techniques, and basic understanding.

14830 **(PB—80-183890) Chest x-ray screening practices: an annotated bibliography. Final report.** Torchia, M.; DuChez, J. (Bureau of Radiological Health, Rockville, MD (USA)). Mar 1980. 65p. NTIS, PC A04/MF A01.

This bibliography represents one of many professional educational activities designed to eliminate nonefficacious x-ray exposure by educating those individuals responsible for requesting x-ray examinations to the factors that should be considered in the selection process. It was developed to complement the work of the BRH-supported Chest X-Ray Referral Criteria Panel. This panel is working to develop appropriate guidelines for selecting asymptomatic persons for chest x-ray screening examinations. Further, this bibliography will serve as a resource guide for educators, students, radiologists, and other medical specialists. It is divided into 10 main topics and contains references chosen for their relevance to the subject of patient selection. Each article contains an abstract to allow individuals a quick review of an article.

14831 **(PB—80-929410) Oral and head and neck cancer. Special listing.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). 3 Jul 1980. 70p. NTIS PC $5.25/MF$3.00.

The Special Listing of Current Cancer Research Projects is a publication of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute. Each Listing contains descriptions of ongoing projects in one selected cancer research area. The research areas include: Diagnostic and prognostic studies of oral and head and neck cancers; Treatment of oral and head and neck cancers; Rehabilitation and other support following treatment of oral and head and neck cancers; Etiology, epidemiology, and follow-up studies of patients with oral and head and neck cancers; Training programs for dental professions; Broad clinical programs for treatment of head and neck cancers; Salivary gland pathology.

14832 **Transplantation of murine bone marrow without prior host irradiation.** Brecher, G.; Tjio, J.H.; Haley, J.E.; Narla, J.; Beal, S.L. (Univ. of California, San Francisco). *Blood Cells ;* **5**: 237-246(1979).

The experiments presented test the hypothesis that pluripotential stem cells (assayed in the mouse as CFU-S) are normally not in cycle and that the failure of normal marrow transfusions to take in normal recipients is due to the absence of a stimulus to turn CFU-S into cycle. Following marrow transfusion from male donors into female isogeneic recipients, spleen, liver, and various parts of the skeleton were shielded to protect transfused donor cells from lethal doses of radiation given to the rest of the body. Percentages of hemopoietic donor and host cells were subsequently determined by karyotyping C banded marrow and spleen metaphases and identifying of Y chromosome. The results support the notion that the failure of normal marrow to take in normal recipients is not due to inadequate numbers of transfused cells. Permanent colonization by donor cells, however, requires not only triggering CFU-S into cycle, but also emptying of niches normally occupied by endogenous CFU-S. Partial body radiation meets both requirements. In addition, the results indicate that recently arrived donor cells, protected in the shielded portion of the body, seed more readily into the irradiated areas of the skeleton than do similarly protected host cells.

14833 **Body electrolyte composition in normal subjects and hypertensive patients on therapy.** Yasumura, S.; Brennan, B.L.; Letteri, J.M.; Zanzi, I.; Ellis, K.J.; Roginsky, M.; Cohn, S.H. (Downstate Medical Center, Brooklyn, NY). Contract EY-76-C-02-0016. *Mineral and Electrolyte Metabolism ;* **2**: 94-102(1979).

The body electrolyte composition was investigated in normal subjects and in treated patients with a history of hypertension. The total body sodium (TBNa), potassium (TBK), chloride (TBCl), and calcium (TBCa) were measured by total body neutron activation analysis (TBNAA). Exchangeable sodium (Na/sub e/), potassium (K/sub e/), and bromide (Br/sub e/) were determined by isotope dilution using ^{24}Na, ^{43}K, and ^{77}Br. The direct measurement of TBCl provided a rapid alternative method for the estimation of ECF which appears to be at least as accurate as that obtained by isotope dilution. TBCa and TBK are the most useful bases for the normalization of TBNa, Na/sub e/, and ECF values. Since obesity and diuretic therapy may introduce error when TBK is used as the reference base, care must be taken in its application in these situations. Under these circumstances, TBCa may be the most useful base for normalization as it is relatively uninfluenced by diuretics. Patients with a history of hypertension on therapy, appear to have increased TBNa, Na/sub e/, and ECF values when normalized to TBK, TBCa, and lean body mass as compared to normal control subjects. Whether the expanded Na/sub e/ and ECF compartments are causal or coincidental in treated hypertensives remains to be investigated.

5507 Microbiology

REFER ALSO TO CITATION(S) 13558, 13568, 14788, 14809, 14810, 14813, 14822, 14853, 14885

14834 Ecological distribution of Legionella pneumophila. Fliermans, C.B. (Savannah River Lab., Aiken, SC); Cherry, W.B.; Orrison, L.H.; Smith, S.J.; Tison, D.L.; Pope, D.H. Contract AC09-76SR00001. *Applied and Environmental Microbiology ;* **41**: No. 1, 9-16(Jan 1981).

Bacteria were concentrated 500-fold from 20-liter water samples collected from 67 different lakes and rivers in the United States. The data suggest the Legionella pneumophila is part of the natural aquatic environment and that the bacterium is capable of surviving extreme ranges of environmental conditions. The data further demonstrate the effectiveness of the direct fluorescent-antibody technique for detecting L. pneumophila in natural aquatic systems. Smears of the concentrated samples were screened microscopically for serogroups of L. pneumophila by the direct fluorescent-antibody technique. Virtually all of the 793 samples were found to be positive by this method. The 318 samples containing the largest numbers of positive bacteria which were morphologically consistent with L. pneumophila were injected into guinea pigs for attempted isolations. Isolates were obtained from habitats with a wide range of physical, chemical, and biological parameters. Samples collected monthly from a thermally altered lake and injected into guinea pigs demonstrated a seasonality of infection, with the highest frequency of infection occurring during the summer months.

14835 Rates of microbial transformation of polycyclic aromatic hydrocarbons in water and sediments in the vicinity of a coal-coking wastewater discharge. Herbes, S.E. (Oak Ridge Nationsl Lab., TN). Contract W-7405-ENG-26. *Applied and Environmental Microbiology ;* **41**: No. 1, 20-28(Jan 1981).

To facilitate predictions of the transport and fate of contaminants at future coal conversion facilities, rates of microbial transformation of polycyclic aromatic hydrocarbons were measured in stream water and sediment samples collected in the vicinity of a coal-coking treated wastewater discharge from November 1977 through August 1979. Six radiolabeled polycyclic aromatic hydrocarbons were incubated with sediment and water samples; $^{14}CO_2$, cell-bound ^{14}C, and polar transformation products were isolated and quantified. Whereas $^{14}CO_2$ and bound ^{14}C were major transformation products in sediment assays, soluble polar ^{14}C dominated transformation in water samples. These results are consistent with the hypothesis that continuous inputs of polycyclic aromatic hydrocarbons result in an increased ability within a microbial community to utilize certain polycyclic aromatic hydrocarbons. However, because transformation rates remained elevated for more than 1 year after removal of the polycyclic aromatic hydrocarbon source, microbial communities may shift only slowly in response to changes in polycyclic aromatic hydrocarbon concentrations.

14836 Inorganic carbon limitation and chemical composition of two freshwater green microalgae. Goldman, J.C. (Woods Hole Oceanographic Inst., MA); Graham, S.J. Contract AC02-78ET20604. *Applied and Environmental Microbiology ;* **41**: No. 1, 60-70(Jan 1981).

Two freshwater Chlorophytes, Chlorella vulgaris and Scenedesmus obliquus, were grown in inorganic carbon-limited continuous cultures in which HCO_3^- was the sole source of inorganic carbon. The response of the steady-state growth rate to the external total inorganic carbon concentration was reasonably well described by the Monod equation; however, the response to the internal nutrient concentration was only moderately well represented by the Droop equation when the internal carbon concentration was defined on a cellular basis. The Droop equation was totally inapplicable when total biomass (dry weight) was used to define internal carbon because the ratio of carbon to dry weight did not vary over the entire growth rate spectrum. In batch cultures, maximum growth rates were achieved at the CO_2 levels present in atmospheric air and at HCO_3^- concentrations of 3 mM. No growth was observed at 100% CO_2. Both nitrogen uptake and chlorophyll synthesis were tightly coupled to carbon assimilation, as indicated by the constant C/N and C/chlorophyll ratios found at all growth rates. The main influence of inorganic carbon limitation appears to be not on the chemical structure of the biomass, but rather on cell size; higher steady-state growth rates lead to bigger cells.

14837 Virus removal during groundwater recharge: effects of infiltration rate on adsorption of poliovirus to soil. Vaughn, J.M.; Landry, E.F.; Beckwith, C.A.; Thomas, M.Z. (Brookhaven National Lab., Upton, NY). *Applied and Environmental Microbiology ;* **41**: No. 1, 139-147(Jan 1981).

Studies were conducted to determine the influence of infiltration rate on poliovirus removal during groundwater recharge with tertiary-treated wastewater effluents. Experiments were conducted at a uniquely designed, field-situated test recharge basin facility through which some 62,000 m^3 of sewage had been previously applied. Recharge at high infiltration rates (75 to 100 cm/h) resulted in the movement of considerable numbers of seeded poliovirus to the groundwater. Moderately reduced infiltration rates (6 cm/h) affected significantly improved virus removal. Very low infiltration rates (0.5 to 1.0 cm/h), achieved by partial clogging of the test basin, yielded the greatest virus removal efficiencies.

5508 Morphology

14838 Organelle membranes from germinating castro bean endosperm. Donaldson, R.P. (George Washington Univ., Washington, DC); Tully, R.E.; Young, O.A.; Beevers, H. Contract EY76-S-03-0034. *Plant Physiology ;* **67**: No. 1, 21-25(Jan 1981).

Glyoxysome ghosts were isolated from germinating castor bean endosperms using established methods. Electron microscopic examination showed that some matrix material was retained within the glyoxysomal membrane. Two cytochrome reductases and phosphorylcholine glyceride transferase co-sedimented with the alkaline lipase, a known component of the glyoxysome membrane, in sucrose gradient centrifugation of osmotically shocked glyoxysomes. The activities of these enzymes in the glyoxysome membranes were compared to those in the endoplasmic reticulum relative to phospholipid content. On this basis, the phosphorylcholine glyceride transferase was 10-fold more active in the endoplasmic reticulum, whereas the lipase was 50-fold more active in the glyoxysome membrane. The cytochrome reductases were only 2-fold more active in the endoplasmic reticulum, indicating that they are components of the two membranes. Difference spectroscopy of the glyoxysome membrane suspension revealed the presence of a b5-type cytochrome similar to that found in the endoplasmic reticulum. Since the glyoxysome membrane is apparently derived from the endoplasmic reticulum, components of the endoplasmic reticulum such as these are likely to be incorporated into the glyoxysome membrane during biogenesis. Enzyme activites involving the cofactors NADH or CoA were measurable in broken, but not in intact, glyoxysomes. Thus, it appears that cofactors for enzymes within the organelle cannot pass through the membrane.

14839 Age changes in human bone: an overview. Sharpe, W.D. (Cabrini Medical Center, New York, NY). Contract E(11-1)3377. *Bulletin of the New York Academy of Medicine ;* **55**: No. 8, 757-773(Sep 1979).

The human skeleton steadily changes structure and mass during life because of a variety of internal and external factors. Extracellular substance and bone cells get old, characteristic structural remodeling occurs with age, and these age-related changes are important in the discrimination between pathological and physiological changes during old age. Perhaps 20% of the bone mass is lost between the fourth and the ninth decades, osteoblasts function less efficiently, and gradual loss of bone substance is enhanced by delayed mineralization of an increased surface area of thin and relatively less active osteoid seams. After the fifth decade, osteoclasia and the number of Howship's lacunae increase and, with age, the number of large osteolytic osteocytes increases as the number of small osteocytes declines and empty osteocyte lacunae become more common. The result is greater liability to fracture and diminished healing or replacement of injured bone.

5509 Pathology

14840 (DOE/EV/02423—1) Studies of membrane structure by freeze-etching. Annual report, January 1-December 31, 1980. Branton, D. (Harvard Univ., Cambridge, MA (USA). Biological Labs.). 1980. Contract AS02-76EV02423. 7p. NTIS, PC A02/MF A01.

Investigations of membrane structure that are ultimately intended to provide a better understanding of the parameters which modulate cell behavior in response to environmental perturbants and which regulate the movement of materials from the outside environment to the inside of living cells are reported.

14841 Breast cancer a result of endocrine targeting (How women differ from rats or mice. Warren, S.; Is brown, C.E.; Chute, R.N. (New England Deaconess Hospital, Boston, MA). Contract EY-76-S-02-3017. *Annals of Clinical Laboratory Science ;* **9**: No. 2, 87-93(1979).

Parabiosis of female rats with castrate males or oophorectomized females produces carcinoma of the breast in the matority of intact females. When unilateral nephrectomy of each partner is added to the procedure, the incidence is 100 percent. Radioimmunoassays for luteinizing hormone (LH), folicle-stimulating hormone (FSH), prolactin, estradiol and progesterone have been performed on the sera of these rats. The pathogenesis of the breast carcinomas is discussed in the light of these results. An attempt to weigh various factors thought to be involved in causing human and experimental rat cancer of the breast suggests signficant differences of a quantitative nature.

14842 Plasma lipoproteins and coronary heart disease. Scanu, A.M. (Univ. of Chicago, IL). Contract EY-76-C-02-0069. *Annals of Clinical Laboratory Science ;* **8**: No. 2, 79-83(Mar 1978).

Both plasma low-density (LDL) and high-density lipoproteins (HDL) have been associated with the genesis of cardiovascular disease. Recent studies with cells grown in culture have suggested a regulatory role of these lipoproteins in cellular cholesterol metabolism and pointed at abnormalities resulting from deviations of these regulatory processes. The precise relationship between these observations in vitro and the atherogenic process remains open to investigation.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 14763, 14808, 14812, 14833, 14839, 14841, 14865, 14882

14843 Temperature and salinity effects on development of striped bass eggs and larvae. Morgan, R.P. II (Univ. of Maryland, Frostburg); Rasin, V.J. Jr.; Copp, R.L. *Transactions of the American Fisheries Society ;* **110**: No. 1, 95-99(Jan 1981).

Responses of eggs and larvae of striped bass, Morone saxatilis, to a series of temperature-salinity combinations were measured as percent hatch, percent survival of larvae 24 hours after hatch, and larva length for the temperature range of 10 to 28 C and the salinity range of 0 to 10%. Optimal temperature was 18 C, and optimal salinity varied, for the majority of these variables.

14844 Metal binding by intestinal mucus. Coleman, J.R.; Young, L.B. (Univ. of Rochester, NY). pp 801-806 of Scanning electron microscopy. II. O'Hare, IL; SEM Inc. (1979).

Electron probe microanalysis offers distinct advantages for the study of intestinal mucus. This technique permits analysis of metal binding in situ, requires only a small amount of tissue, allows several experiments to be performed with one animal, and can resolve variations in binding that may occur in different portions of the intestine. We have used electron probe microanalysis to examine the metal binding capacity of intestinal mucus in situ. We have exposed portions of excised intestine to various concentrations of several metals, rapidly frozen the tissue and freeze dried it. After anhydrous embedding, thick sections were cut and analyzed on silicon discs or carbon coated copper grids. Qualitative analysis shows two distinctive patterns of distribution. The results of this work show clearly that at least three divalent cations are bound by mucus, that mucus exhibits different affinities for different metals, and that binding of metals is not uniform throughout mucus.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 13710, 14168, 14864, 14884

14845 Orchard foliage temperature model. Welles, J.M.; Norman, J.M.; Martsolf, J.D. (Pennsylvania State Univ., University Park). Contract EC-77-5-2-4397. *Journal of the American Society for Horticultural Science ;* **104**: No. 5, 602-610(1979).

A model that computes orchard foliage temperature distributions in a heated orchard is described. The energy balance for individual foliage elements is computed, considering thermal radiation from the environment, plus the radiative and convective effects of an array of orchard heaters. The model is used to analyze various heater configurations and densities, and to determine rates of fuel consumption required for frost protection. The results indicate that radiative heating of the foliage by the heaters is as important as convective heating of the air, even though only one-fifth of the fuel contributes to radiation emission. Further, results suggest several simple passive methods for increasing the efficiency of orchard heating.

14846 Algal nutrition in the sea: management possibilities. North, W.J. pp 215-230 of Marine plant biomass of the Pacific Northwest Coast. Krauss, R. (ed.). Corvallis, OR; Oregon State Univ. Press (1978).

Considerable information is available concerning algal nutrition under laboratory culture conditions. There are also several compendia that summarize the many analyses of elemental composition of marine algae. In contrast, relatively little is known about management of algal nutrition under natural conditions. Specialists can usually identify unhealthy plants in nature, but only rarely are able to prove that the cause of a problem does indeed arise from a nutritional deficiency. The Japanese and Chinese have undertaken fertilizing experiments and operations among their algal crops. Judging from descriptions which have been published in English, fertilizing activities in the Orient have largely been trial and error operations. They do not seem to be based on an extensive body of knowledge that permits assessment of the condition of the water or the needs of the crop in a given estuarine or coastal environment. Occasionally plant nutrients, typically nitrogen and phosphorus concentrations, are monitored in aquaculturing operations. It is widely and probably correctly assumed that nitrogen is an important limiting nutrient in the marine environment. Inorganic N often falls to low, even undetectable, concentrations in oceanic surface waters. Levels of both N and P tend to rise as depth increases because nutrient regeneration processes below the euphotic zone are no longer coupled to nutrient accumulation by growing plants. The ratios of maximum N and P concentrations at various depths to the surface concentrations cover a broad range of values - from about 10 to more than 400 in one survey.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

14847 (NUREG/CR—1174) A study to determine the feasibility of conducting epidemiologic investigations of the health effects of low-level ionizing radiation. Phase I report. Interim technical report 3 July 79-15 January 80. Dreyer, N.A.; Clapp, R.W.; Covino, S.J. Jr; Fahey, F.H.; Friedlander, E.R. (Equifax, Inc., Reading, MA (USA). Health Systems Div.). Jan 1980. 132p. NTIS, PC A07/MF A01.

This is the six-month interim report of 'A Study to Determine the Feasibility of Conducting Epidemiologic Investigations of the Health Effects of Low-Level Ionizing Radiation', begun July 3, 1979. The study defines low-level radiation as either doses up to 5 rem (whole-body) per year or doses up to 50 rem (whole body) cumulative. The overall intent of the study is a dual one: (1) to insure

that all likely exposed population groups are identified, and (2) to determine at the operational level the requirements for feasibility, i.e. study design, data gathering, information potential and cost for future epidemiologic studies of low-level radiation exposure. Three criteria were developed to select the best prospects for in-depth feasibility studies of the dose-response relationship in the low-dose range. A rigorous application of these criteria would have eliminated all candidates from consideration. Nevertheless, the authors selected seven broadly-defined low-exposure groups that seemed most promising. These groups were exposed to either occupational or diagnostic medical radiation. In addition, owing to strong public interest, the authors selected three groups with special environmental radiation exposures, although this was not specifically required by the contract.

14848 **(NUREG/CR—1261) A mathematical model for predicting the probability of acute mortality in a human population exposed to accidentally released airborne radionuclides. Final report for Phase I of the project: early effects of inhaled radionuclides.** Filipy, R.E.; Borst, F.J.; Cross, F.T.; Park, J.F.; Moss, O.R. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1980. Contract AC06-76RLO1830. 122p. NTIS, PC A06/MF A01.

The report presents a mathematical model for the purpose of predicting the fraction of human population which would die within 1 year of an accidental exposure to airborne radionuclides. The model is based on data from laboratory experiments with rats, dogs and baboons, and from human epidemiological data. Doses from external, whole-body irradiation and from inhaled, alpha- and beta-emitting radionuclides are calculated for several organs. The probabilities of death from radiation pneumonitis and from bone marrow irradiation are predicted from doses accumulated within 30 days of exposure to the radioactive aerosol. The model is compared with existing similar models under hypothetical exposure conditions. Suggestions for further experiments with inhaled radionuclides are included.

14849 **(NUREG/CR—1427) Effect of dose rate in altering immunohematologic factors in mammals. Preliminary report.** Shifrine, M.; Wilson, F.D. (California Univ., Davis (USA). Lab. for Energy-Related Health Research). Apr 1980. 73p. NTIS, PC A04/MF A01.

There is an urgent need to confirm the comparative effectiveness of chronic low level radiation in an experimental model in order to generate data that will enable regulatory agencies to establish standards for permissible exposures. Data from our initial study using exposure rates of 0.7 R/day and 0.33 R/day compared to higher rates (1, 2, 4 and 11 R/day) have suggested that only at the higher exposure rates and from cumulative exposures over 1000 R can any effects on the immunohematologic system be observed. The proposed continuation of studies will allow the authors to measure with very sensitive techniques (shown to detect meaningful changes at higher doses) any changes in immunohematology due to low level exposure rates to cumulative totals of 75 and 375 R. The authors could then state, based on experimental results, whether in fact these exposures are proportionally deleterious or not. In addition, the continuation of these studies will permit us to correlate early changes in immunohematological parameters with late effects; i.e., leukemia.

14850 **(ORAU/IEA—80-15(M)) Critique of procedures for estimating absolute risk and a general expression for excess radiation risk.** Groer, P.G. (Oak Ridge Associated Universities, Inc., TN (USA). Inst. for Energy Analysis). Dec 1980. Contract AC05-76OR00033. 30p. NTIS, PC A03/MF A01.

The statistical procedures commonly used to estimate the absolute risk for radiation-induced cancer are valid only under two conditions: if (1) the cancer rates (force of mortality) in the exposed and unexposed groups are constant over time, and (2) the radiogenic rate increases linearly with radiation dose. The absolute risk model associated with these procedures implies, therefore, that the mean number of excess cancers increases linearly with time and dose in the absence of competing causes of death. However, evidence exists in the literature that spontaneous cancer rates are strongly time dependent. The assumptions of constant rate and of linear increase with dose in the radiogenic rate must, therefore, be verified before statistical procedures based on these assumptons can be applied. I show that two statistical methods - hazard plots and total-time-on-test plots - can be used to test these assumptions. An analysis of data on the effects of ^{239}Pu in beagles and ^{226}Ra in humans illustrates the usefulness of these methods. A realistic but simple example, using data on leukemia induction in Hiroshima survivors, shows how the additional risk to a population should be estimated if all causes of death are present.

14851 **(PB—80-174956) Quantitative analysis of the reduction in organ doses in diagnostic radiology by means of entrance exposure guidelines. Final report.** Laws, P.W.; Rosenstein, M. (Bureau of Radiological Health, Rockville, MD (USA)). Feb 1980. 29p. NTIS, PC A03/MF A01.

Reductions in organ dose for entrance exposure guidelines set at the seventy-fifth percentile were computed, using observed distributions for the eight radiographic projections in the Bureau of Radiological Health's Nationwide Evaluation of X-Ray Trends. Exposure guidelines for these projections, when accompanied by an optimum quality assurance program, could reduce the average exposures falling in the fourth quartile by 57 to 70 percent, with corresponding average organ dose reductions of 47 to 68 percent. Dose reductions greater than 50 mrad (0.5 mGy) per exposed film are projected for at least one organ for all but one projection. The larger dose reductions were for the AP Thoracic Spine projection - lungs, 280 mrad (2.8 mGy); breasts, 590 mrad (5.9 mGy) - and the AP Full Spine projection - thyroid, 230 mrad (2.3 mGy); breast, 210 mrad (2.1 mGy).

14852 **Residual radiation damage in the mouse foot after exposure to heavy particles.** Carpenter, S.G.; Raju, M.R. (Los Alamos Scientific Lab., NM). *Radiology ;* **138**: No. 2, 483-485(Feb 1981).

From 67. scientific assembly and annual meeting; Chicago, IL, USA (15 Nov 1981).

Mice receiving a first treatment with graded doses of various heavy charged particles to one of their hind legs were re-exposed to a fixed dose of x rays eight months later to study the memory of residual damage from the first treatment. No significant memory of the first radiation exposure was observed for acute skin reaction. However, there is an indication of memory for foot deformity. The results do not seem to indicate any significant differences in memory after exposure to ^{60}Co gamma rays compared with protons or heavy ions, if biological effectiveness of the doses is taken into consideration.

14853 **Microbial cells as biosorbents for heavy metals: accumulation of Uranium by Saccharomyces cerevisiae and Pseudomonas aeruginosa.** Strandberg, G.W.; Shumate, S.E. II; Parrott, J.R. Jr. (Oak Ridge National Lab., TN). Contract W-7405-ENG-26. *Applied and Environmental Microbiology ;* **41**: No. 1, 237-245(Jan 1981).

Uranium accumulated extracellularly on the surfaces of Saccharomyces cerevisiae cells. The rate and extent of accumulation were subject to environmental parameters, such as pH, temperature, and interference by certain anions and cations. Uranium accumulation by Pseudomonas aeruginosa occurred intracellularly and was extremely rapid (<10 s), and no response to environmental parameters could be detected. Metabolism was not required for metal uptake by either organism. Cell-bound uranium reached a concentration of 10 to 15% of the dry cell weight, but only 32% of the S. cerevisiae cells and 44% of the P. aeruginosa cells within a given population possessed visible uranium deposits when examined by electron microscopy. Rates of uranium uptake by S. cerevisiae were increased by chemical pretreatment of the cells. Uranium could be removed chemically from S. cerevisiae cells, and the cells could then be reused as a biosorbent.

14854 **Cell survival in spheroids irradiated with heavy-ion beams.** Rodriguez, A.; Alpen, E.L. (Univ. of California, Berkeley). Contract W-7405-ENG-48. *Radiation Research ;* **85**: No. 1, 24-37(Jan 1981).

Studies have been carried out with x rays and high-energy carbon and neon ion beams to evaluate high-LET cell survival in terms of RBE and possible contributions of intercellular communi-

cation. Comparisons were made of the postirradiation survival characteristics for cells irradiated as multicellular spheroids and for cells irradiated in suspension. Comparison is made with 225-kVp x rays, 400 MeV/amu carbon ions, and 425 MeV/amu neon ions. X-ray cell survival curves for cells from spheroids had larger D_0's than did the survival curve for cells grown in single-cell suspension. Comparison of the effectiveness of the proximal, mid, and distal regions of the spread-out Bragg peak of carbon ions for cell killing in spheroids indicated that cell inactivation increased as a function of increasing LET. The survival dose relationship in the mid and distal peak regions was exponential, and the RBE, at 10% survival, was 1.9 and 2.1 compared to 1.5 for the proximal peak. Examination of survival data for various regions in the spread Bragg peak of neon showed that a maximum RBE at 10% survival of 2.5 was found for the midpeak, while the lowest RBE value of 1.6 for neon was found for irradiation in the distal peak. We conclude that the higher average LET (200 keV/μm) in the distal peak region of the neon beam exceeds the maximally effective LET, which for this ion is probably below this value.

14855 DNA synthesis in generation 1 in x-irradiated HeLa cells. Hawkins, R.B. (Washington Univ., St. Louis, MO); Tolmach, L.J.; Griffiths, T.D. Contract AC02-76EV03490. *Radiation Research ;* **85**: No. 1, 85-98(Jan 1981).

Measurements of DNA replication in a line of HeLa S3 cells during the generation (Generation 1) following that in which the cells are irradiated with 500 rad of 220-kV x rays (Generation 0) were carried out according to a number of different experimental protocols. These involved preirradiation labeling of the cells with low levels of [^{14}C] thymidine in Generation-1 to provide a measure of the template DNA, synchronization by mitotic collection in Generation 0, resynchronization by either mitotic recollection or temporary drug-induced blockages in Generation 1, and either labeled-thymidine incorporation or density-label transfer during Generation 1. The results show that those cells that progress through S phase of Generation 1 and divide at the next mitosis replicate a full complement of DNA. However, apparent deficits of as much as 45% are measured if resynchronization in Generation 1 is effected by drug tretment following manipulations of the culture in the presence of particular media and drugs during Generation 0. These are attributed to combined radiation- and drug-induced disturbances in cell progression.

14856 Distribution and retention of ^{243,244}Cm in the adult baboon. Lo Sasso, T.; Cohen, N.; Wrenn, M.E. (New York Univ., NY). *Radiation Research ;* **85**: No. 1, 173-183(Jan 1981).

The metabolism of ^{243,244}Cm citrate has been studied in six adult female baboons for periods ranging up to 26 months after intravenous injection. In vivo measurements with γ-ray scintillation detectors were used to estimate parameters of deposition and retention of ^{243,244}Cm for the total body and specific organ sites. In addition, ^{243,244}Cm was measured in urine, feces, blood, and biopsy samples of liver. Curium-243,244 leaves the blood rapidly. The primary sites of early deposition are skeleton and liver. The retention of ^{243,244}Cm in bone is protracted with a half-time of several years, while that in liver is about 40 days. Approximately 7% of the injected dose is excreted in the urine during the first 24 h. Curium-243,244 eliminated from the liver appears to be excreted predominantly in feces as in the case for ^{241}Am.

14857 Yield of DNA strand breaks and their relationship to DNA polymerase I-dependent repair synthesis and ligation following x-ray exposure of toluene-treated Escherichia coli. Billen, D. (Oak Ridge National Lab., TN). Contract EY-76-S-05-4568;W-7405-ENG-26. *Radiation Research ;* **85**: No. 1, 202-206(Jan 1981).

In Escherichia coli made permeable to nucleotides by toluene treatment, a DNA polymerase I-directed repair synthesis is observed. This is an exaggerated repair synthesis which can be abruptly terminated by the addition of the DNA ligase cofactor, nicotinamide adenine dinucleotide. This communication describes experiments which bear on the relationship between measurable strand breaks, DNA polymerase I-directed, exaggerated repair synthesis, and strand-break repair.

14858 Distribution of photosynthetically fixed ^{14}C in perennial plant species of the northern Mojave Desert. Wallace, A.; Cha, J.W.; Romney, E.M. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 192-200(1980).

The distribution of photosynthate among plant parts subsequent to its production is needed to fully understand behavior of vegetation in any ecosystem. The present study, undertaken primarily to obtain information on transport of assimilates into roots of desert vegetation, was conducted in the northern Mojave Desert, where the mean annual rainfall is about 10 cm. Shoots of Ambrosia dumosa (A. Gray) Payne plants were exposed to $^{14}CO_2$ in 1971, and the distribution of ^{14}C in roots, stems, and leaves was subsequently measured at 1 week, 2 months, and 5 months. Only about 12 percent of the ^{14}C photosynthate was stored in the root. Much of that stored in stems was available for new leaf growth. Photosynthate was labeled with ^{14}C for 24 plants representing eight species in 1972. Results showed that after 127 days the mean percentage of ^{14}C in roots as compared with the estimate of that originally fixed was 11.8; the percentage in stems was 43.8. To check the validity of the ^{14}C data, root growth of eight perennial desert plants grown in the glasshouse was followed as plants increased in size. The mean percent of the whole plant that was root for eight species was 17.7 percent. The mean proportion of the increase in plant weights that went below ground for the eight species was 19.5 percent. This value is higher than the fraction of ^{14}C found below ground, and therefore the ^{14}C technique underestimates the movement of C to roots. Results of an experiment designed to test the value of the ^{14}C-pulse technique for determining current root growth for some perennial species from the desert indicated that the transition part of roots where root growth continued after exposure to ^{14}C was highly labeled. Old growth contained less ^{14}C than new growth.

14859 ^{14}C distribution in roots following photosynthesis of the label in perennial plants in the northern Mojave Desert. Wallace, A.; Mueller, R.T.; Cha, J.W.; Romney, E.M. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 177-191(1980).

In April and May of 1973, 24 individual plants were exposed to $^{14}CO_2$ with techniques used in our other studies in the field. Seven to 8 months later, part of the plants were excavated and counted by plant part for ^{14}C. The remainder of the plants were excavated at 13 months. The results indicated that from 3 to 20 percent of the carbon for leaves in the next year came from stems and roots of Grayia spinosa (Hook) Moq., Ceratoides lanata (Pursh) J. T. Howell, Atriplex confertifolia (Torr. and Frem.) S. Wats., Lycium pallidum Miers, Ambrosia dumosa (A. Gray) Payne, and Acamptopappus shockleyi A Gray. Nearly all of the root segments were labeled at sampling time; however, some of the roots were labeled at higher amounts than others. Some roots had very little ^{14}C, and these are assumed to be very new roots rather than dead roots because of their small size. The roots with high levels of ^{14}C are assumed to be formed near the time of labeling, and those with low levels to be formed after the time of labeling. From 17 to 65 percent of the ^{14}C fixed was recovered after 7 to 13 months.

14860 Persistence of ^{14}C labeled carbon in Larrea tridentata up to 40 months after photosynthetic fixation in the northern Mojave Desert. Wallace, A.; Romney, E.M.; Cha, J.W. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 172-176(1980).

Larrea tridentata (Sesse Moc. ex DC) Cov. exposed to $^{14}CO_2$ retained about 20 percent of its ^{14}C after 16 and also after 26 months. In leaves, however, a lower specific activity was present at 26 months than at 16 months, and a smaller percentage of ^{14}C in the plant occurred in leaves at 26 months than at 26 months (3 percent vs 10 percent). This indicates some, but little, reuse of carbon from the structural components of the plants. The strong tendency of the species to retain this carbon may be related to a survival mechanism. After 40 months the results were more erratic, with 11 percent of ^{14}C remaining in plants and only 2 percent of the total remaining in the leaves. The specific activity of ^{14}C in the organic debris fraction obtained with saturated salt flotation of roots after small and fine roots had been physically removed indicated that from 27 to 35 percent of the organic debris had the same specific activity as roots and probably could be considered as roots. This

compares with the 45 percent value determined previously by a different technique. The below-ground to aboveground ratio for biomass of these plants was about 2.5:1. The below-ground to aboveground ratio for the ^{14}C was about 0.5 at 16 months, 1.3 at 26 months, and 2.5 at 40 months. The estimates obtained in this study were used to correct our previous data for below-ground biomass. Accordingly,somewhere between 3000 and 5000 kg/ha roots are present in the Rock Valley area. An increase wth time of the below-ground to aboveground ^{14}C ratio probably indicates loss of ^{14}C from above-ground parts rather than additional transport to roots.

14861 **Retranslocation of tagged carbon in Ambrosia dumosa.** Wallace, A.; Cha, J.W.; Mueller, R.T.; Romney, E.M. (Univ. of California, Los Angeles). *Great Basin Nat.;* No. 4, 168-171(1980).

Ambrosia dumosa (A. Gray) Payne cuttings grown in solution culture were exposed to $^{14}CO_2$ to measure the distribution of labeled photosynthate among leaves, stems, and roots after 4, 24, and 48 h. For all sampling periods, the highest levels of ^{14}C were found in leaves and the lowest in roots; however, considerable ^{14}C had moved to roots in 48 h. In a 12-week study of A. dumosa in solution culture, plants increased in size more than 17 times and flowered and produced seeds. The plants had received $^{14}CO_2$ in photosynthesis at the start. The gradual loss of ^{14}C from the plants in the 12 weeks averaged 3.5 percent per week (coefficient of variation = 58 percent). This represents an average respiration rate of 0.21 mg C g dry weight^{-1} h^{-1}. This compares favorably with other means for determining respiration rate. The percentage of ^{14}C in the root portion of the plant varied little over 6 sampling periods, indicating that essentially none of the initially fixed ^{14}C left the roots during the 12 weeks of test. The ^{14}C entering fruits and seeds came from leaves only. The biomass of fruit parts resulted more from new photosynthate than from retranslocation from leaves. In a study in which A. dumosa plants were defoliated, little ^{14}C moved from roots to new shoot growth.

14862 **Dose-rate conversion factors for external exposure to photons and electrons.** Kocher, D.C. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 84-85(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14863 **Consideration of the need for evacuation to protect public safety at Three Mile Island.** Hull, A.P. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 91-92(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14864 **Sewage solids as supplemental feed for ruminants grazing rangeland forage.** Smith, G.S. (New Mexico State Univ., Las Cruces); Kiesling, H.E.; Herbel, C.H.; Ray, E.E.; Trujillo, P.; Orcasberro, R.; Sivinski, J.S. *Transactions of the American Nuclear Society ;* **34**: 338-339(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14865 **Irradiation-induced canine leukemia: a proposed new model. Incidence and hematopathology.** Tolle, D.V.; Seed, T.M.; Fritz, T.E.; Norris, W.P. pp 247-256 of Experimental hematology today 1979. Baum, S.J.; Ledney, G.D. New York, NY; Springer-Verlag Inc. (1979).

With precise control of the leukemogenic stimulus (^{60}Co gamma irradiation) we have produced a high incidence of both myelogenous and erythroleukemia in the dog that is clinically, hematologically, and histologically similar to the human disease. Because these radiation-induced canine leukemias are reproducible, and occur in high incidence, and because the dog is a large animal, which is easily manipulated clinically, it is an attractive alternative animal model for the hematologist-oncologist interested in leukemogenesis and especially in developing new clinical therapies.

14866 **Three additional genes involved in pyrimidine dimer removal in Saccharomyces cerevisiae: RAD7, RAD14, and MMS19.** Prakash, L.; Prakash, S. (Univ. of Rochester, NY). *Molecular amp General Genetics ;* **176**: 351-359(1979).

The ability to remove ultraviolet (uv)-induced pyrimidine dimers from the nuclear DNA of yeast was examined in two radiation-sensitive (rad) mutants and one methyl methanesulfonate-sensitive (mms) mutant of the yeast Saccharomyces cerevisiae. The susceptibility of DNA from irradiated cells to nicking by an endonuclease activity prepared from crude extracts of Micrococcus luteus was used to measure the presence of dimers in DNA. The rad7, rad14, and mms19 mutants were found to be defective in their ability to remove uv-induced dimers from nuclear DNA. All three mutants belong to the same epistatic group as the other mutants involved in excision-repair. All three mutants show enhanced uv-induced mutations. The rad 14 mutant also shows epistatic interactions with genes in the other two uv repair pathways.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 13855, 14784

14867 **(ORNL/TM—7630) Bioenergetics of sauger in Watts Bar Reservoir. Environmental Sciences Division publication No. 1648.** Minton, J.W.; McLean, R.B.; Singley, P.T. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 82p. NTIS, PC A05/MF A01.

Thesis. Submitted by J.W. Minton to Univ. of Tennessee, Knoxville.

This 17-month study describes the energy budget of sauger in Watts Bar Reservoir, Tennessee, in order to assess the effects of prey fluctuations on that major predator. Direct field determinations of consumption and laboratory determinations of metabolism are organized in the balanced energy equation of Winberg (1956) to predict the growth in energy value of typical sauger in two year classes. The Winberg equation is modified to include the energetic costs of specific dynamic action and the efficiency penalty of catabolizing body energy stores to realistically reflect energetics principles. Directly measured caloric growth and predicted growth over the growing season (March-October) agree within 5.0 to 13.2% for the two age classes modeled, thus verifying the model application. Predicted and observed gains over the winter were much more divergent, suggesting that the physiological assumptions of the balanced energy equation are invalid for describing the winter energetics of sauger. Further investigations of the growth efficiency of percids at low temperatures, or observations of field activity in the winter, or both are warranted. Watts Bar sauger grew quickly in comparison to other populations. Modeling indicated that this rapid growth was the result of storing energy obtained by winter predation upon threadfin shad and young-of-the-yeargizzard shad, of heavy feeding upon shad in early summer, of prey switching to species of equal or superior energy value, and of maintaining minimum levels of metabolic energy expenditures. In early summer sauger fed heavily on vulnerable shad which were concentrated in coves to spawn. Predation upon shad was again very heavy when winter cold stress rendered them vulnerable. Cold stressed shad are also susceptible to impingement upon powerplant intake screens and shad predation by sauger was correlated with impingement of shad at Kingston Steam Plant both winters of study.

5603 Chemicals Metabolism And Toxicity

14868 **(AD-A—087854) Formaldehyde - an assessment of its health effects. Final report.** (National Research Council, Washington, DC (USA). Advisory Center on Toxicology). Mar 1980. 47p. NTIS, PC A03/MF A01.

This document is an evaluation of the effects of formaldehyde on animals, humans, and in in vitro tests, with emphasis on health risks of exposure to airborne formaldehyde at low concentrations. Consumers have complained of eye and upper respiratory tract irritation, headaches, drowsiness, and gastrointestinal disturbances, apparently caused by offgassing of formaldehyde from urea-formaldehyde foam insulation, particle board, or plywood. Airborne concentrations of formaldehyde in homes have been reported to range from 0.01 to 31.7 ppm. An ongoing lifetime in rodent indi-

cated there may be a carcinogenic effect of exposure to formaldehyde. A high incidence of squamous cell carcinoma in the nasomaxillary epithelium was reported in rats exposed at 15 ppm. Irritation appears to be the most sensitive response to formaldehyde. However, identification of the toxicologic reaction of greatest concern will have to await the conclusion of ongoing and planned studies. A range of irritation responses associated with exposure to various concentrations of formaldehyde was provided, but there was no evidence of a population threshold for formaldehyde's irritant effects. The Committee recommended that formaldehyde be kept at the lowest practical concentration to minimize adverse effects on public health. Several factors were suggested for consideration in the selection of such a concentration and research needs were identified.

14869 **(HRP—0030846/0) Long-term effects on health of air pollution.** (World Health Organization, Copenhagen (Denmark). Regional Office for Europe). 1978. 49p. NTIS, PC A03/MF A01.

Field studies were conducted under the auspices of the World Health Organization to explore the possible impact of long-term exposure to air pollution on health. A meeting was held in Poland in 1977 to review studies of air pollution and its effect on the health of children, assess methods used in these studies, and suggest ways in which additional studies might be undertaken. Field studies in Czechoslovakia, Denmark, the Netherlands, Greece, Poland, Spain, and Yugoslavia, as well as a coordinated respiratory study of the Commission of European Communities, were reviewed. It was determined that, in three countries, a probable association existed between long-term exposure to air pollution and certain respiratory indexes in children. In the remaining countries, study findings tended to be inconclusive. Support was indicated for continued investigation into the health effects of air pollution on children and for providing financial support to conduct studies focusing on both children and the elderly. Supporting data are provided, and additional information on the studies is appended.

14870 **(ORNL—5708) Methods for ecological toxicology: a critical review of laboratory multispecies tests. Environmental Sciences Division Publication No. 1710.** Hammons, A.S. (ed.). (Oak Ridge National Lab., TN (USA)). Feb 1981. Contract W-7405-ENG-26. 320p. (EPA—560/11-80-026). NTIS, PC A14/MF A01.

An evaluation is presented of selected laboratory methods for measuring ecological effects, and tests considered most suitable for research and development are recommended for use in predicting the effects of chemical substances on interspecific interactions and ecosystem properties. The role of mathematical models in chemical hazard assessment is also discussed. About 450 references are cited. A bibliography of more than 700 references is provided. The Office of Toxic Substances, U.S. Environmental Protection Agency (EPA) is responsible for implementing the Toxic Substances Control Act (TSCA). TSCA, promulgated in 1976, is comprehensive legislation designed to broadly protect human health and the environment from unreasonable risks resulting from the manufacture, processing, distribution, use, and disposal of a chemical substance. Under TSCA, EPA is responsible for identifying and prescribing test standards to be used in developing the data necessary to predict the risks associated with chemical releases into the environment. To aid EPA in this endeavor, laboratory methods for measuring the effects of chemical substances on aquatic and terrestrial interspecific interactions and ecosystem processes were reviewed and evaluated for their potential for standardization for use in environmental hazard and risk assessment processes. The criteria used for these evaluations include whether or not the tests are:rapid, reproducible, relatively inexpensive, unequivocal, sensitive, socially relevant, predictive, generalizable, and well-developed.

14871 **(PB—80-171093) Predicting effects of an electric generating station on wetland passerine birds: Wisconsin power plant impact study.** Jaeger, M.J. (Wisconsin Univ., Madison (USA). Inst. for Environmental Studies). Jan 1980. 33p. NTIS, PC A03/MF A01.

The distribution of breeding passerines (songbirds) was investigated in a wetland in southern Wisconsin to develop a model for use in predicting changes in bird freguencies resulting from environmental alterations. The wetland is adjacent to the cooling lake of a coal-fired electric generating station. The water levels in the wetland are being altered by the cooling lake's effect on the local ground-water system. The model uses information on distributions of bird species along gradients of water depth and vegetation-structure characteristics and information on the relationships between the characteristics to predict changes in bird species' frequencies resulting from increased water levels.

14872 **(PB—80-173669) Results of benthic studies at Chalk Point. Interim report.** Holland, A.F.; Hiegel, M.H.; Cargo, D.G.; Mountford, N.K. (Maryland Univ., Solomons (USA). Chesapeake Biological Lab.). Jan 1980. 280p. NTIS, PC A13/MF A01.

This report summarizes the results of annual cycle in the benthos of the Patuxent River and the effects of the Chalk Point Power Station on those benthos.

14873 **(PB—80-181282) Health effects of ozone and other photochemical oxidants in the Chicago area. Final report.** Hallenbeck, W.; Kojola, W.; Allen, R.; Scheff, P.; Melius, J. (Illinois Univ., Chicago (USA). School of Public Health). Sep 1979. 93p. NTIS, PC A05/MF A01.

The objectives of this report were: (1) to examine pertinent literature for its relevance in assessing the human health effects of exposure to ozone and other photochemical oxidants in the Chicago metropolitan area (2) to determine the feasibility of conducting a study of the health effects of ozone and other oxidants in the Chicago area (3) to develop the general methodology for conducting a study of the health effects of exposure to ozone and other photochemical oxidants in the Chicago area, and (4) to determine if photochemical oxidants other than ozone are present in the Chicago area. It was concluded that the existing literature is insufficiently complete to allow the assessment of the human health effects of exposure to ozone and other photochemical oxidants in the Chicago area. Therefore, the feasibility of conducting a study of the health effects of exposure to photochemical oxidants in the Chicago area was explored. It was concluded that there are areas in Chicago which experience quite different levels of ozone and that it is feasible to carry out a health effects study in the Chicago area.

14874 **(PB—80-181944) The health consequences of sulfur oxides: a report from CHESS (Community Health and Environmental Surveillance System), 1970-1971, May 1974. Appendum.** (Environmental Protection Agency, Washington, DC (USA)). Apr 1980. 263p. NTIS, PC A12/MF A01.

A controversy about the scientific credibility of results from the Community Health and Environmental Surveillance System (CHESS) study prompted a series of Congressional hearings in 1976 ('The Brown Report') with subsequent legislation (Public Law 95-155) to enact the Environmental Research, Development and Demonstration Authorization Act of 1978. This addendum has been compiled to satisfy Recommendation 3(c) of The Brown Committee Report, entitled 'The Environmental Protection Agency's Research Program with Primary Emphasis on the Community Health and Environmental Surveillance System (CHESS): An Investigative Report.' It contains the following materials which concern the 1974 CHESS Monograph and various CHESS studies, in addition to EPA's research and development program in general: as follows The Brown Committee Report; P.L. 95-155; Appendices from EPA's Research Outlook for 1978 and 1979; and the Science Advisory Board's Health Effects Research Review Group Report to Congress in February 1979.

14875 **(PB—80-205834) Algal bioassays with leachates and distillates from western coal.** Gerhart, D.Z.; Richter, J.E.; Curran, S.J.; Robertson, T.E. (Minnesota Univ., Duluth (USA). Dept. of Biology). May 1980. 79p. NTIS, PC A05/MF A01.

The objective of this research was to assess the effects on freshwater algae of materials derived from coal storage piles. Coal leachates and distillates were prepared in the laboratory from low-sulfur Montana coal. Three types of algal bioassays were conducted: (1) A laboratory stream facility was constructed which supported periphyton communities of 50-80 species growing on artificial

substrates. These communities generally showed stimulation of growth and some species composition changes in response to coal leachates. Coal distillates inhibited growth. Periphyton exposed to distillates accumulated aliphatic hydrocarbons. (2) Short-term laboratory bottle tests with test species of algae generally showed growth inhibition in response to leachates and distillates. When distillates were bubbled to remove volatile organic compounds, growth stimulation was observed. (3) Three in-situ experiments in a small lake were conducted with coal distillates. Increases in algal biomass and bacterial populations in distillate-treated enclosures were observed in each of these tests.

14876 **(PB—80-208390) Report to the National Commission on Air Quality on the benefit methodology evaluation panel. Final report.** (National Commission on Air Quality, Washington, DC (USA)). May 1980. 18p. NTIS, PC A02/MF A01.

The Benefit Methodology Evaluation Panel was convened by the National Commission on Air Quality to evaluate methods for the estimation of benefits resulting from enhanced air quality. The Panel assessed the relative merits of alternative approaches taken in major studies for estimating benefits of air pollution control. The Panel focused on human health issues and recommended that the Commission review major macroepidemiological studies; that standardized methods of measuring morbidity be developed; and that the Commission should not include benefit estimates in its regional studies.

14877 **(PB—80-806961) Iodine in foods. February 1974-December 1979 (citations from the Food Science and Technology Abstracts data base). Report for February 1974-December 1979.** Young, C.G. (New England Research Application Center, Storrs, CT (USA)). May 1980. 288p. NTIS PC N01/MF N01.

The bibliography cites reports dealing with determination, content and effects of iodine in foods and beverages such as milk and water. Methods of determination include utilization of ion-selective electrodes, gas chromatography and neutron activation analysis. I values of fats and oils are reported, as well as effects of iodophor preparations used for washing udders and milk equipment. (Contains 188 abstracts)

14878 **(PNL-SA—8629) Kinetics and mechanisms for the formation of organic pollutants during pyrolysis and combustion.** Smith, R.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1981. Contract AC06-76RL01830. 3p. NTIS, PC A02/MF A01.

Results indicate the formation of higher molecular weight products has a maximum, as a function of temperature, in the 1200°C to 1400°C range for all aromatic systems studied thus far. This maximum is apparently nearly independent of pressure below about 10 torr. Initial results of the gas phase pyrolysis have supported the suggestion of two distinct routes for the formation of polycyclic aromatic hydrocarbons and soot. Below approximately 1450°C direct condensation of aromatic precursor, leads to higher molecular weight compounds, and ultimately some soot formation. At higher temperatures initial pyrolysis reactions result in the formation of reactive lower molecular fragments (CH_3, C_2H_2, C_3H_3, C_4H_2, etc.), which are highly efficient in forming soot by heterogeneous processes but are less efficient in forming aromatic species (however, reaction does apparently speed greatly upon cooling). Our gas phase studies have also identified a number of highly reactive intermediate hydrocarbons for the formation of higher molecular weight compounds (e.g., C_3H_3, C_4H_3, C_5H_5, and C_7H_7). Experiments are being planned to better define the heterogeneous chemistry of these high temperature aromatic systems, relate experimental results to actual combustion experiments and to explore equilibrium calculations for estimating the concentrations of important species at high temperatures.

14879 **(PNL-SA—8987) Assessing mutagenic effects by likelihood methods.** Bowen, W.M.; Tolley, H.D. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Sep 1980. Contract AC06-76RL01830. 19p. (CONF-801045—8). NTIS, PC A02/MF A01.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

To induce a given mutation rate in laboratory studies, the promutagen substrate requires at least minimum levels of certain precursor compounds. Since insufficient levels of a precursor ostensibly reduce the mutagenicity of an agent, statistical methods of fitting laboratory data must take into account this law of the minimum phenomenon. A major difficulty with the statistical estimation arises from the fact that the observable mutation response is the minimum of a number of potential responses which are unobservable except for the minimum. Each of the potential responses can be modeled in terms of the dose levels of the promutagen and the precursors. For a given mutation experiment, however, it is not known which of the potential mutation responses has been observed. A methodology implementing the law of the minimum structure is presented which provides maximum likelihood estimates of the parameters of the potential response models. A numerical example is presented to illustrate the proposed methodology.

14880 **(UCRL—85297) Techniques for the generation and monitoring of vapors.** Nelson, G.O. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 6 Feb 1981. Contract W-7405-ENG-48. 20p. (CONF-810219—1). NTIS, PC A02/MF A01.

From Symposium on the genotoxic effects of airborne agents; Upton, NY, USA (Feb 1981).

Controlled test atmospheres can be produced using a variety of techniques. Gases are usually generated by using flow dilution methods while vapors are produced by using solvent injection and vaporization, saturation, permeation and diffusion techniques. The resulting gas mixtures can be monitored and measured using flame ionization, photoionization, electrochemical and infrared analytical systems. An ideal system for the production of controlled test atmospheres would not only be able to generate controlled test atmospheres, but also monitor all pertinent environmental parameters, such as temperature, humidity, and air flow.

14881 **Effect of oxygenated sterol compounds on human bone marrow granulocytic progenitor cells.** Hoffman, P.C.; Richman, C.M.; Hsu, R.C.; Chung, J.; Scanu, A.M.; Yachnin, S. (Univ. of Chicago, IL). Contract EY-76-C-02-0069. *Blood ;* **57**: No. 1, 164-169(Jan 1981).

Oxygenated sterol compounds are potent inhibitors of sterol and DNA synthesis in mammalian cells. We studied the effects of oxygenated sterols on human marrow granulocytic progenitor cells in vitro (CFU-C)*. 25-Hydroxycholesterol, as well as 6-ketocholestanol, 7-ketocholesterol, and 20 α-hydroxycholesterol, demonstrated marked inhibition of CFU-C proliferation. The latter effect, which was not a result of direct cytoxicity of the compounds, was reversible by cholesterol, but not by mevalonic acid. We conclude that inhibition of sterol synthesis by oxygenated sterol compounds may be insufficient to explain their suppression of CFU-C proliferation.

14882 **Distribution and excretion of lead in young and adult female mice.** Keller, C.A.; Doherty, R.A. (Univ. of Rochester, NY). *Environmental Research ;* **21**: 217-228(1980).

The kinetics of whole body lead elimination and organ distribution were studied in 10-day-old and adult female mice following a single dose of lead. Necropsies were performed periodically during the 50-day experiment to assess organ lead distributions and lead elimination. Between Days 15 and 50 excretion of lead was found to occur nearly equally through urinary and fecal routes. Whole body lead retention during the terminal elimination phase was observed to have a half-time simular to that of lead retained in femur. Rates of lead elimination from femur and from whole body of young mice were apparently less rapid than comparable elimination rates in adult mice. Lead fluxes from the brains of young and adult mice were closely approximated by single component exponential equations. The results suggest that a three-compartment model does not adequately account for the kinetics of lead distribution and retention in mouse brain after a single dose.

14883 **Sorption of cadmium and its effect on growth and the utilization of inorganic carbon and phosphorus of two freshwater diatoms.** Conway, H.L. (Argonne National Lab., IL); Williams, S.C. *Journal of the Fisheries Research Board of Canada ;* **36**: No. 5, 579-586(1979).

Cadmium was rapidly sorbed by Asterionella formosa and Fragilaria crotonensis during the first 5 to 10 min of exposure (0.05

to ~ 9 μg $Cd.L^{-1}$), followed by a hyperbolic increase in the cellular cadmium content as a function of time. Results obtained from experiments conducted in the light and dark, experiments using live and dead populations, and cellular site location studies imply that the sorption of cadmium by A. formosa is partially an active process, but for F. crotonensis it appears to be passive. Populations of A. formosa exhibited a corresponding decrease in the growth rate as the ambient cadmium concentration was increased from ~ 2 to ~ 9 $\mu g.L^{-1}$. In contrast, the growth rate of F. crotonensis was unaffected at levels ranging from ~ 0.05 to ~ 9 μg $Cd.L^{-1}$. The utilization of inorganic carbon by A. formosa was unaffected at ~ 4 μg $Cd.L^{-1}$, but reduced 45% at ~ 9 μg $Cd.L^{-1}$. The utilization rates of carbon and phosphorus by F. crotonensis were reduced at the lower cadmium concentrations and enhancd at the highest.

14884 **Field estimate of SO_2 deposition velocities to rapidly growing soybeans.** Sprugel, D.G.; Miller, J.E. (Argonne National Lab., IL). *Water, Air, and Soil Pollution ;* **12**: 233-236(1979).

Field-grown soybeans were exposed to elevated SO_2 levels in an open-air fumigation system which produced minimal alteration of the crop environment. The increase in S content of the fumigated plants as compared to unfumigated controls was used to estimate the deposition velocity of SO_2 to the crop. Estimates ranged from 0.5 to 0.9 cm s^{-1}, which is in the lower part of the range found by micrometerological techniques, confirming that estimates based on short-term gradient measurements are realistic.

14885 **Effects of polychlorinated biphenyls on macromolecular synthesis by a heterotrophic marine bacterium.** Blakemore, R.P. (Woods Hole Oceanographic Institution, MA). *Applied and Environmental Microbiology ;* **35**: No. 2, 329-336(Feb 1978).

Growth rates and final cell yields of a polychlorinated biphenyl (PCB)-sensitive pseudomonad isolated from the open ocean were reduced in a dose-dependent manner by 10 to 100 μg of Aroclor 1254 per liter, a commercial mixture of PCB isomers added to its culture medium. Effects on growth rates were detected within 1 h (approximately one doubling time) of treatment. By 4 h posttreatment, the amounts of deoxyribonucleic acid and ribonucleic acid per cell in exponentially growing populations treated with sublethal doses of Aroclor were detectably lower than in appropriate controls. Corresponding cell protein values were slightly higher than in controls. Selective degradation of cell proteins or nucleic acids was not detected in cells whose growth was totally suppressed for 4 h by PCBs. Cells whose growth rate was inhibited 20 to 50% by Aroclor synthesized protein at normal rates for periods in excess of 5 h from the time the chlorinated hydrocarbons were added. In contrast, rates per cell of adenine uptake and adenine incoporation into deoxyribonucleic acid and total nucleic acids by the cells treated with PCBs were significantly lower than in control cells. Intracellular adenine pools of cells whose growth was inhibited to 20% of the control rate by PCBs were 30% smaller and appeared to require a longer interval to equilibrate than those of untreated cells. This may indicate impaired transport and/or efflux of this nucleic acid precursor through the membrane of affected cells. Inhibition of nucleic acid synthesis in this sensitive bacterium by PCBs could explain the observed inhibitory effects of the chlorinated hydrocarbons on its growth.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 14897

14886 **(PB—80-193188) Walk-through survey report on rf radiation exposures from heat sealers at wilson jones company, 6150 touhy avenue, chicago, illinois 60648.** Herrick, R.F.; Murray, W.E. Jr; Egan-Baum, B.; Kramkowski, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 8 May 1980. 18p. NTIS, PC A02/MF A01.

On June 26, 1979, NIOSH conducted a walk-through survey of the radiofrequency (RF) heat sealing area at the Wilson Jones Company, in Chicago, Illinois. The purpose of the survey was to identify a population of workers which could be used in a study to determine if any health effects are associated with occupational exposures to RF radiation. A potential cohort of workers was identified in the RF heat sealing area of the Binding Division. Electric fields produced by the RF heat sealers were measured to document exposure levels. The electric field strength levels exceeded 200 V/M (duty cycle corrected) on two of five heat sealers evaluated. Confounding exposures were assessed and appear not to be a factor. Personnel record systems were evaluated as to their suitability for use in a study of reproductive histories. The cohort identified could be used in the study of reproductive histories. The cohort identified could be used in the study if combined with similar cohorts from other plants. The Wilson Jones Company is being considered as a possible participant in the NIOSH study.

14887 **(PB—80-195233) Walk-through survey report- rf (radio-frequency) radiation exposures from heat sealers at S. I. Jacobson Manufacturing Company, 1414 South Wabash Avenue, Chicago, Illinois 60605.** Herrick, R.F.; Egan-Baum, B.; Murray, W.E. Jr. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 7 May 1980. 20p. NTIS, PC A02/MF A01.

On June 27, 1979, NIOSH conducted a walk-through survey of the radio-frequency (RF) heat sealing area at the S.I. Jacobson Manufacturing Company, Chicago, Illinois. The purpose of the study was to identify a population of workers which could be used in a study to determine if any health effects are associated with occupational exposures to RF radiation. Electric fields produced by the RF heat sealers were measured to document exposure levels. The electric field strength levels exceeded 200 V/M (duty cycle corrected) on five of the nine heat sealers evaluated. Confounding exposures were assessed and appear not to be a factor. Personnel record systems were evaluated as to their suitability for use in a study of reproductive histories. It appears from the personnel records that an appropriate cohort of RF heat sealer workers and a corresponding control group cannot be identified, therefore, the S.I. Jacobson Manufacturing Company will not be included in the NIOSH study. Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

14888 **Gas bubble disease in smallmouth bass and northern squawfish from the Snake and Columbia Rivers.** Montgomery, J.C.; Becker, C.D. (Pacific Northwest Labs., Richland, WA). Contract EY-76-C-06-1830. *Transactions of the American Fisheries Society ;* **109**: No. 6, 734-736(Nov 1980).

In 1975 and 1976, 179 smallmouth bass (Micropterus dolomieui) and 85 northern squawfish (Ptychocheilus oregonensis) were collected by angling from the lower Snake and mid-Columbia rivers, southeastern Washington. All fish were examined externally for gas bubble syndrome. Emboli were found beneath membranes of the opercula, body, and fins of 72% of the smallmouth bass and 84% of the northern squawfish. Hemorrhage was also noted on the caudal, anal, and pectoral fins of several smallmouth bass. Presence of gas bubble syndrome corresponded to the spring runoff when total dissolved gas supersaturations in river water exceeded 115%.

14889 **Ultrasound lethality to synchronous and asynchronous Chinese hamster V-79 cells.** Fu, Y.K. (Univ. of Rochester, NY); Miller, M.W.; Lange, C.S.; Griffiths, T.D.; Kaufman, G.E. EY-76-C-02-0069. *Ultrasound in Medicine and Biology ;* **6**: 39-46(1980).

Chinese hamster V-79 cells were exposed in suspensions for 1 to 15 min to 1.1 MHz continuous wave (cw) ultrasound at axial intensities from 0.25 to 30 W/cm^2. Cell lysis was evidenced by a decrease in the number of intact cells, and loss of reproductive integrity was evidenced by a decrease in the plating efficiency of the remaining intact cells. The magnitude of these effects was a function of both intensity and exposure duration. Mitotically synchronized cells displayed a differential sensitivity depending upon cell cycle position. The M and S phases of the cell cycle were more resistant with respect to cell lysis and loss of reproductive integrity than were the G_1 and G_2 phases.

14890 **Increased G_2 duration in sonicated root meristem cells of Pisum sativum.** Miller, M.W. (Univ. of Rochester, NY). *Environmental and Experimental Botany ;* **19**: 357-364(1979).

Roots were exposed to 2.3 MHz ultrasound at intensity levels of 7 and 11 W/cm^2. The meristematic cells yielded an intensity dependent delay in their transit through G_2 + 1/2 M.

57 HEALTH AND SAFETY

14891 (DOE/ET/13560—7) Assessment of documentation requirements under DOE 5481.1, Safety Analysis and Review System (SARS). Browne, E.T. (Meyer (A.F.) and Associates, Inc., McLean, VA (USA)). Mar 1981. Contract AM01-80ET13650. 21p. NTIS, PC A02/MF A01.

This report assesses the requirements of DOE Order 5481.1, Safety Analysis and Review System for DOE Operations (SARS) in regard to maintaining SARS documentation. Under SARS, all pertinent details of the entire safety analysis and review process for each DOE operation are to be traceable from the initial identification of a hazard. This report is intended to provide assistance in identifying the points in the SARS cycle at which documentation is required, what type of documentation is most appropriate, and where it ultimately should be maintained.

14892 (DOE/ET/13650—4) Evaluation of alternative review plans for the Department of Energy safety analysis and review system. Browne, E.T.; Meyer, A.F. Jr. (Meyer (A.F.) and Associates, Inc., McLean, VA (USA)). Feb 1981. Contract AM01-80ET13650. 35p. NTIS, PC A03/MF A01.

This technical report presents A.F. Meyer and Associates, Inc.'s evaluation of alternative means of providing the independent safety analysis reviews required under DOE 5481.1. The relative merits of the following entities performing the reviews are discussed: DOE Headquarters Staff; DOE Operations Offices; DOE Energy Technology Centers; Contractors/Consultants; and Organizational Combinations. This report is intended to provide a basis for a policy decision to be made by DOE officials. Thus, although the pros and cons of each alternative are delineated herein, no recommended course of action is specified.

14893 (DOE/ET/13650—8) Safety analysis and review system (SARS) assessment report. Browne, E.T. (Meyer (A.F.) and Associates, Inc., McLean, VA (USA)). Mar 1981. Contract AM01-80ET13650. 12p. NTIS, PC A02/MF A01.

Under DOE Order 5481.1, Safety Analysis and Review System for DOE Operations, safety analyses are required for DOE projects in order to ensure that: (1) potential hazards are systematically identified; (2) potential impacts are analyzed; (3) reasonable measures have been taken to eliminate, control, or mitigate the hazards; and (4) there is documented management authorization of the DOE operation based on an objective assessment of the adequacy of the safety analysis. This report is intended to provide the DOE Office of Plans and Technology Assessment (OPTA) with an independent evaluation of the adequacy of the ongoing safety analysis effort. As part of this effort, a number of site visits and interviews were conducted, and FE SARS documents were reviewed. The latter included SARS Implementation Plans for a number of FE field offices, as well as safety analysis reports completed for certain FE operations. This report summarizes SARS related efforts at the DOE field offices visited and evaluates the extent to which they fulfill the requirements of DOE 5481.1.

14894 (DOE/ET/13650—10) Safety analysis review terms of reference. Hurley, T. (Meyer (A.F.) and Associates, Inc., McLean, VA (USA)). Mar 1981. Contract AM01-80ET13650. 17p. NTIS, PC A02/MF A01.

This document has been prepared to suggest procedures and items for consideration in the review of safety analysis prepared on DOE fossil energy conversion and technology development projects. It is not intended to reflect official DOE policy. It does, however, provide a basis for consistency in conducting reviews, especially with regard to interpreting levels of risk. Since many of the persons assigned to review panels are not expected to be safety analysts but specialists in related fields such as industrial hygiene and environmental science, this document is intended to provide general terms of reference to facilitate review procedures.

14895 (DOE/ET/13650—11) Audit and appraisal plan for occupational safety and health program. Phase I. Meyer, A.F. Jr. (Meyer (A.F.) and Associates, Inc., McLean, VA (USA)). Mar 1981. Contract AM01-80ET13650. 39p. NTIS, PC A03/MF A01.

This report summarizes the work in support of the ASFE occupational safety and health program: the study has (1) investigated alternative schemes for prioritizing industry cost share plants and facilities for site visits; (2) examined alternative mechanisms for these overviews and appraisals; and (3) developed cost data for the several alternatives. In effect, this has been as paper study in lieu of on-site evaluations.

14896 (DOE/EV—0091/2) Operational accidents and radiation exposures at DOE facilities. Fiscal year 1979. (Department of Energy, Washington, DC (USA). Office of Environmental Compliance and Overview). Dec 1980. 38p. NTIS, PC A03/MF A01.

The Department of Energy's safety performance in fiscal year 1979 showed improvement in all categories over fiscal year 1978. The loss rates were less than one-half the United States industry average as reported by the National Safety Council. Incidence rates per 200,000 workhours were 1.1 lost workday cases and 17.2 lost workdays compared to 1.2 lost workday cases and 17.6 lost workdays during fiscal year 1978. The recordable occupational illness rate, based on only 80 cases, was 0.06 cases per 200,000 workhours compared to 0.07 cases per 200,000 workhours for fiscal year 1978. Nine fatalities of contractor employees resulted in an annual rate of 6.0 deaths per 100,000 workers compared with 10 fatalities during fiscal year 1978, and an annual rate of 6.7 deaths per 100,000 workers. The total Department of Energy property loss reported during fiscal year 1979 was $3.3 million; $765,400 was caused by fire, and $2.5 million by other causes. A total of 121 million vehicle miles of official travel resulted in 685 accidents with $338,400 in property damage. The loss rates of 5.7 accidents per million vehicle miles and $2.80 per 1000 miles were improvements over the fiscal year 1978 rates of 5.8 accidents per million vehicle miles and $2.97 property damage per 1000 miles. The 104,986 monitored Department of Energy and its contractor employees received a total dose of 9040 rem in calendar year 1979. Both the total dose and the 1748 employees receiving radiation exposures greater than 1 rem in 1979 represent a continuing downward trend from the calendar year 1978 total dose of 9380 rem and the 1826 employees who received radiation exposures greater than 1 rem.

14897 (PB—80-193196) Walk-through survey report on rf radiation exposures from heat sealers at Holum and Sons, Inc., 740 Burr Oak Drive, Westmont, Illinois 60559. Herrick, R.F.; Egan-Baum, B.; Murray, W.F. Jr. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1980. 19p. NTIS, PC A02/MF A01.

On June 25, 1979, NIOSH conducted a walk-through survey of the RF heat sealing area at Holum and Sons, Inc., in Westmont, Illinois. The purpose of the study was to identify a population of workers which could be used in a study to determine if any health effects are associated with occupational exposures to radiofrequency radiation. Electric fields produced by the RF heat sealers were measured to document exposure levels. The electric field strength levels exceeded 200 V/M (duty cycle corrected) on two of the six heat sealers evaluated. Confounding exposures were assessed and appear not to be a factor. Personnel record systems were evaluated as to their suitability for use in a study of reproductive histories. It appears from the personnel records that an appropriate cohort of RF heat sealer workers and a corresponding control group cannot be identified, therefore, Holum and Sons, Inc., will not be included in the NIOSH study.

14898 (PB—80-193352) Occupational exposure to talc containing asbestos. Morbidity, mortality, and environmental studies of miners and millers. Dement, J.M.; Zumwalde, R.D.; Gamble, J.F.; Fellner, W.; DeMeo, M.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Feb 1980. 117p. NTIS, PC A06/MF A01.

The National Institute for Occupational Safety and Health (NIOSH) conducted studies of mortality and morbidity patterns and occupational exposures among talc miners and millers in upper

New York. The mortality study was based on 398 white male workers who began employment between January 1, 1947 and December 31, 1959 and whose vital status was determined as of June 30, 1975. Observed cause specific mortality for the cohort as compared with that expected based on U.S. white male mortality rates indicated a significant increase in mortality due to bronchogenic cancer, nonmalignant respiratory disease (excluding influenza and pneumonia) and respiratory tuberculosis. The average latency period for bronchogenic cancer was 20 years.

14899 **(PB—80-194053) Development of occupational disease guides. Final report 23 June 77-15 May 1978.** O'Connor, B.M.; Christakis, G. (Bendix Corp., Cocoa Beach, FL (USA). Launch Support Div.). 8 May 1978. Contract PHS-NIOSH-210-77-0089. 160p. NTIS, PC A08/MF A01.

Ten guidelines for the determination of occupational diseases are presented to assist in establishing the work and substance relatedness of disease in individual workers. The chemical and common names are provided for the following 10 substances: antimony (7440360), inorganic arsenic (7440382), benzene (71432), coke oven emissions, cotton dust, inorganic lead (7439921), inorganic mercury (7439976), nitrogen dioxide (10102440), crystalline silica (7631869), and sulfur dioxide (7446095). For each substance, occupations with potential exposure, medical examinations, differential diagnosis, symptoms, clinical analysis, epidemiology, exposure data, and threshold limit values are discussed.

14900 **(SAND—81-0321C) Analysis technique for preventing fires in nuclear power plants and other facilities.** Berry, D.L. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 34p. (CONF-810320—1). NTIS, PC A03/MF A01.

From Society of Fire Protection engineering symposium; College Park, MD, USA (4 Mar 1981).

For nuclear power plants or other facilities in which a fire could pose a significant risk to public health and safety, a conservative analysis technique was developed to identify and protect fire areas having the greatest safety importance. By performing a parametric heat balance for a room, temperature changes versus time were calculated as a function of fuel load, room size, and air flow rate. When combined with time-temperature criteria used in fire barrier testing, the parametric heat balance equations defined those combinations of fuel load and air flow for which barriers can be expected to survive under the most severe fire conditions. The results of this barrier analysis were expressed as a fire spread matrix for a particular nuclear power plant. By solving the matrix with a network flow computer model, an optimum fire protection strategy can be devised for ensuring the safety of the most critical plant areas.

14901 **(UCID—18945) Safety assessment document for the environmental test complex (Building 834) at Site 300.** Odell, B.N.; Pfeifer, H.E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Mar 1981. Contract W-7405-ENG-48. 102p. NTIS, PC A06/MF A01.

A safety assessment was performed to determine if accidents occurring at the 834 Complex at Site 300 could present undue hazards to the general public, personnel at Site 300, or have an adverse effect on the environment. The credible accidents that might have an effect on these facilities or have off-site consequences were considered. These were earthquake, extreme wind (including missiles), lightning, flood, criticality, high explosive (HE) detonation that disperses uranium and beryllium, spontaneous oxidation of plutonium, explosions due to finely divided particles, and a fire. Seismic and extreme wind (including missiles) analyses indicate that the buildings are basically sound. (However, there are a few recommendations to further enhance the structural integrity of these facilities). Additional lightning protection for these facilities is being installed. These buildings are located high above the dry creek bed so that a flood is improbable. A criticality or a high explosive detonation involving plutonium is very remote since the radioactive materials are encased and plutonium and HE are not permitted concurrently in the same area at Site 300. (The exceptions to this policy are that explosive actuating devices are sometimes located in assemblies containing fissile materials. However, a planned or accidental actuation will not effect the safe containment of the fissile material within the assembly). Even though the possibility of an HE explosion involving uranium and beryllium is remote, the off-site lung doses were calculated and found to be below the accepted standards. It was determined that a fire was unlikely due to the low fire loading and the absence of ignition sources. It was also determined that the consequences of any accidents were reduced by the remote location of these facilities, their design, and by administrative controls.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 13470, 13479, 14170

14902 **(ONWI—107) Use of K-Ar dating and oxygen isotopes for determining the thermal history of shales.** Weaver, C.A. (Georgia Inst. of Tech., Atlanta (USA)). Aug 1980. Contract AC06-76RL01830. 68p. NTIS, PC A04/MF A01.

A review of the literature suggests that the isotopes of potassium and oxygen can be used to determine the paleotemperatures of shales and other rocks containing clay minerals. During diagenesis K-bearing smectites and illites lose Ar and gain K over a temperature range of 40° to 400°C. This causes a decrease in the apparent K-Ar age. The release of $^{40}Ar/^{39}Ar$ by stepwise heating affords a series of apparent K-Ar ages which may include both the detrital age and the ages produced by diagenetic changes. The difference between $^{18}O/^{16}O$ ratios of quartz and illite that have reached isotopic equilibrium can be used to calculate maximum burial temperature. The K-Ar apparent age of size fractions of a diagenetic series of illitic shales varies as a function of temperature. It is possible to use $^{18}O/^{16}O$ temperature values to calibrate a K-Ar geothermometer. A K-Ar geothermometer is designed because the measurements are simpler to make and more reliable than $^{18}O/^{16}O$ measurements.

14903 **(PB—80-181712) The south pole automatic condensation nuclei counter: instrument details and five years of observations.** Murphy, M.E.; Bodhaine, B.A. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). Feb 1980. 94p. NTIS, PC A05/MF A01.

An automatic General Electric (G.E.) condensation nuclei counter has been operating continuously at the Amundson-Scott South Pole station since 1974 as part of the Geophysical Monitoring for Climatic Change (GMCC) program. This instrument (calibrated by a Pollak nuclei counter standard), with its high sensitivity and fast response, can provide continuous aerosol climatology and identify periods of contamination from local sources. The annual variation of nuclei concentration is apparent and is repeatably consistent over the five year period. Nuclei concentrations occasionally reach values as low as 7/cu cm during the austral winter (April through September), begin to increase near the time of astronomical sunrise, and reach values as high as about 240/cu cm during summer months. The continuously operating G.E. condensation nuclei counter in conjunction with the Pollak nuclei counter, have produced an excellent data set over the five year period, 1974-1978.

14904 **(USGS-OFR—80-1263) Analysis of the magnetic susceptibility well log in drill hole UE25a-5, Yucca Mountain, Nevada Test Site.** Hagstrum, J.T.; Daniels, J.J.; Scott, J.H. (Geological Survey, Las Vegas, NV (USA)). 1980. Contract AI08-78ET44802. 35p. NTIS, PC A03/MF A01.

Magnetic susceptibility measurements have been shown to be dependent upon the magnetite content of rocks with variations in rock susceptibility arising from changes in the shape, size, composition, and quantity of the contained magnetite grains. The present study was undertaken to determine the factor(s) responsible for the variation in magnetic susceptibility measurements from borehole UE25a-5 on the Nevada Test Site (NTS). The well logs and sample analyses presented in this paper form part of a larger geophysical well-logging project studying the physical properties of welded tuffs at NTS. The ash-flow sheets at NTS appear to be the products of single compositionally zoned magmas that tend, within a

cooling unit, to erupt hotter, more mafic, and more crystal-rich with time. These factors, however, have little effect on the degree to which the tuffs become welded. Furthermore, zones of crystallization and alteration are superimposed upon the welded units. X-ray data show poor correspondence between the relative abundance of magnetite in a sample and the borehole magnetic susceptibility measurement associated with it. Curie balance experiments demonstrate no change in the magnetic mineralogy that could account for the susceptibility variation. Thin-section observations corroborate the x-ray data, but indicate a proportional relationship between the borehole susceptibility measurements and the grain-size distribution of magnetite. The association of magnetic susceptibility anomalies with the crystal-rich zones of the welded tuffs will aid in the identification and correlation of the eruptive sequences at NTS.

5803 Mineralogy, Petrology, And Rock Mechanics

14905 **Effect of strain rates from 10^{-2} to 10 sec^{-1} in triaxial compression tests on three rocks.** Blanton, T.L. (Science Applications, Inc., Steamboat Springs, CO). *International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts ;* **18**: No. 1, 47-62(Feb 1981).

Room-temperature, compression tests at strain rates from 10^{-2} to 10 sec^{-1} have been run on Charcoal Granodiorite to 0.45 GPa confining pressure and on Berea Sandstone and Indiana Limestone to 0.25 GPa confining pressure. For each rock at each confining pressure, the differential stress at failure is relatively constant up to a strain rate of 1 sec^{-1} and apparently increases abruptly above this strain rate. Dynamic analysis of the testing apparatus indicates that the apparent sudden increase in strength is due to machine inertia and does not reflect a real increase in the strength of the rocks. Taking inertia into account, the actual failure stresses of the three rocks are relatively independent of strain rate betweeen 10^{-2} and 10 sec^{-1}. In the same interval, the strains at which the unconfined rocks begin to fragment tend to be lower at higher strain rates. The combination of decreasing strains and relatively constant stresses with increasing strain rate suggests that the energy necessary to fragment the unconfined rocks is lower at higher strain rates.

5804 Geochemistry

14906 **Hydrocarbon geochemistry of the Puget Sound region. II. Sedimentary diterpenoid, steroid and triterpenoid hydrocarbons.** Barrick, R.C.; Hedges, J.I. (Univ. of Washington, Seattle). Contract EY-76-S-06-2225. *Geochimica et Cosmochimica Acta ;* **45**: No. 3, 381-392(Mar 1981).

Cyclic components of the aliphatic hydrocarbon mixtures extracted from Puget Sound sediment cores include a suite of C_{19} and C_{20} diterpenoid hydrocarbons of which fichtelite, sandaracopimaradiene, and isopimaradiene have been identified. Although apparently also derived from vascular plants, these diterpenoid hydrocarbons have relative abundances distinctly different from the co-existing plant wax n-alkane suite. Five C_{27}, C_{28} and C_{29} diasteranes and four C_{29}, C_{30} and C_{31} 17α(H), 21β(H) hopanes occur in relatively constant proportion as components of a highly weathered fossil hydrocarbon assemblage. These chromatographically resolved cycloalkanes, along with the strongly covarying unresolved complex mixture, have been introduced to Puget Sound sediments from adjacent urban centres at increasing levels over the last 100 yr in the absence of any major oil spill. Naturally-occurring triterpenoid hydrocarbons, including hop-22(29)-ene (diploptene), are also present. A new group of C_{30} polyenes has been detected which contains compounds apparently structurally related to a co-existing bicyclic C_{25} diene and to C_{20} and C_{25} acyclic multi-branched hydrocarbons described in a previous paper (Barrick et al., 1980).

6401 Astrophysics And Cosmology

14907 **(PB—80-197643) Solar-geophysical data number 428, April 1980. Part II (comprehensive reports). Data for October 1979.** (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Apr 1980. 36p. NTIS, PC A03/MF A01.

In addition to an index for 1979-1980, this issue of comprehensive reports provides data for October 1979 on: solar radio emission, energetic solar particles and plasma, and solar x-ray radiation. Solar flare data are now over a year delayed from date of observation, rather than the usual six months. A delay in the final listing of solar flare data also delays the Daily Flare Index, the Regional Flare Index and the Abbreviated Calendar Record.

14908 **(PB—80-212707) Solar-geophysical data number 429, May 1980. Part II (comprehensive reports). Data for November 1979.** (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). May 1980. 44p. NTIS, PC A03/MF A01.

In addition to an index for 1972-1980, this issue of comprehensive reports provides data for November 1979 on: solar radio emission, energetic solar particles and plasma, and solar x-ray radiation. Solar flare data are now over a year delayed from data of observation, rather than the usual six months. A delay in the final listing of solar flare data also delays the Daily Flare Index, the Regional Flare Index and the Abbreviated Calendar Record. Miscellaneous data consists of energetic solar particles October 1979, active regions August 13-September 9, 1979, and synoptic solar maps August 13-September 9, 1979.

14909 **Particle collisions above 10 TeV as seen by cosmic rays.** Gaisser, T.K.; Yodh, G.B. (Bartol Research Foundation of The Franklin Institute, University of Delaware, Newark, Delaware 19711). *Annual Review of Nuclear Science ;* **30**: No. 1, 475-542(Dec 1980).

The use of extensive air shower interactions to study elementary particles is discussed. Among the topics treated are energy dependence of cross sections, emulsion chamber techniques, and new particle production. (AIP)

14910 **Chemical composition, gravity, and temperature of Vega.** Dreiling, L.A.; Bell, R.A. (Lawrence Livermore Laboratory, University of California). W-7405-ENG-48. *Astrophysical Journal ;* **241**: No. 2, 736-758(15 Oct 1980).

Several flux-constant, line-blanketed model stellar atmospheres have been computed for the bright star Vega. The stellar effective temperature has been found to be 9650 K by comparisions of observed and computed absolute fluxes at 5556 A and of relative absolute fluxes between 3300 and 10800 A. The Balmer line profiles give log g=3.9 +- 0.2, consistent with the result from the Balmer jump and with that found from the radius and (estimated) mass. Te Ti II and Fe II curves of growth give abundances of log N(Ti)=4.7 +- 0.3 and log N(Fe)=7.1 +- 0.3 on the scale log N(H)=12.0. These abundances are slightly less than normalized meteoritic values and solar values deduced from ionized lines. The local thermodynamic equilbrium (LTE) Fe I curve of growth gives log N(Fe)=6.9 +- 0.3, whereas correction for non-LTE effects suggests log N(Fe)=7.5 +- 0.3.

6402 Atmospheric Physics

14911 **(AD-A—087850) The increased attachment due to ionization-induced smog in emp environments. Final report 1 Apr 77-31 Oct 79.** Scheibe, M. (Mission Research Corp., Santa Barbara, CA (USA)). 31 Oct 1979. 37p. (MRC-R—532). NTIS, PC A03/MF A01.

The increased electron attachment due to HNO3 production in the EMP source region is investigated. The HNO3 produced is found to be roughly linear with the total ionization up to an ionization value of about 2 x 10 to the 16th power ion pairs. Above this, the HNO3 production is less than linear. Although the attachment to HNO3 was not enough to explain the lightning strokes in the Mike shot, it can affect the field in the EMP source region. The attachment to other species via endothermic reactions which in-

volve electrons which have been heated by the electric field was also investigated. It was concluded that only those reactions in which the energy change is small, such as the reactions with O3 and HNO2 and H2O2, hold much hope of contributing significantly to the overall attachment. The necessary experimental data for these reactions, however, is not available.

14912 **(AD-A—088735) Gerdien condenser instrumentation for measuring high-latitude middle atmosphere electrical parameters. Special report.** Domagalski, K.; Mitchell, J.D. (Texas Univ., El Paso (USA). Schellenger Research Labs.). 31 May 1979. 79p. NTIS, PC A05/MF A01.

Gerdien condensers for measuring electrical conductivity, ion mobility and charge number density were flown in recent rocket programs to investigate the high-latitude middle atmosphere. The instruments were launched in two coordinated programs (Aurorozone I and II) at Poker Flat, Alaska to study the effects of auroral energetics on electrical parameters and in a solar eclipse rocket program at Red Lake, Canada. The design of the Gerdien condenser instrumentation for the Aurorozone II program and the solar eclipse program is considered. In addition, electrical parameters measured for the two auroral programs are presented and discussed. The initial results from the measurements indicate that high-latitude middle atmosphere electrical parameters are strongly influenced by the auroral energetics.

14913 **Chorus, energetic electrons and magnetospheric substorms.** Tsurutani, B.T.; Smith, E.J. (Jet Propulsion Lab., Pasadena, CA (USA)); West, H.I. Jr.; Buck, R.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). pp 55-62 of Wave instabilities in space plasmas. Palmadesso, P.J.; Papadopoulos, K. (Naval Research Lab., Washington, DC (USA)) (eds.). Dordrecht, Netherlands; D. Reidel (1979).

From Symposium on wave instabilities in space plasma; Helsinki, Finland (31 Jul 1978).

The origin(s) of whistler mode chorus in the outer region of the terrestrial magnetosphere has been investigated using simultaneous measurements of chorus, energetic (79 +- 23 keV) electron fluxes and pitch angle distributions and ambient magnetic fields obtained with OGO-5.

14914 **(PB—80-199136) Solar-terrestrial physics services and publications 1980.** (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Apr 1980. 34p. NTIS, PC A03/MF A01.

This brochure is concerned with the products and services in the Solar-Terrestrial Physics (STP) disciplines. The identifications of the STP data disciplines and subdisciplines and related products and services with instructions on how and where to obtain them are given. There are seven major categories of data pertinent to STP. Each contains several subdisciplines. An eighth category contains miscellaneous data which are of interest to STP scientists as well as to those working in other fields. Most of these data categories are archived at NGSDC and are the basis for many of the various NGSDC publications and services.

14915 **(PB—80-202310) Atmospheric Physics and Chemistry Laboratory collected reprints 1974-75.** (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Environmental Research Labs.). Apr 1976. 376p. NTIS, PC A17/MF A01.

This book is a compilation of a variety of reprints from other sources of subjects related to meteorology. The reprints included, are listed in the table of contents alphabetically according to author. The subjects discussed cover a wide variety of meteorological data.

14916 **Dynamics of the magnetosphere.** Akasofu, S.I. (ed.). Dordrecht, Netherlands; D. Reidel (1980). vp. (CONF-7810248—).

From Conference on magnetospheric substorms and related plasma process; Los Alamos, NM, USA (9 Oct 1978).

Papers from these proceedings were processed individually for the data base as they were received from INIS. (RWR)

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 14409, 14958, 14997

14917 **(AD-A—090496) A study of the collisional dynamics for collisions of uf6(-) with atoms and molecules. Final report 1 jul 79-30 jun 80.** Doverspike, L.D.; Champion, R.L. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics). Aug 1980. Contract F49620-79-C-0219. 42p. NTIS, PC A03/MF A01.

Absolute total cross sections for the collisional decomposition of the negative ion of uranium hexafluoride into its three lowest asymptotic channels in collisions with the rare gases were measured for collision energies ranging from below thresholds for decomposition up to a laboratory collision energy of 500eV. The experimental results were found to be consistent with the predictions of a two-step collision model where the unimolecular decomposition of the excited molecular negative ions is described with a statistical theory.

14918 **(CONF-800442—2) Sputtering and secondary ion emission properties of alkali metal films and adsorbed monolayers.** Krauss, A.R.; Gruen, D.M. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 23p. NTIS, PC A02/MF A01.

From Symposium on sputtering; Vienna, Austria (28 Apr 1980).

The secondary ion emission of alkali metal adsorbed monolayer and multilayer films has been studied. Profiling with sub-monolayer resolution has been performed by Auger, x-ray photoemission and secondary ion mass spectroscopy. Characteristic differences in the sputtering yields, and ion fraction have been observed which are associated with both the surface bonding properties and the mechanism leading to the formation of secondary ions. By sputtering with a negative bias applied to the sample, positive secondary ions are returned to the surface, resulting in a reduced sputter-induced erosion rate. Comparison with the results obtained with K and Li overlayers sputtered without sample bias provides an experimental value of both the total and secondary ion sputtering yields. The first and second monolayers can be readily identified and the first monolayer exhibits a lower sputtering yield and higher secondary ion fraction. This result is related to adsorption theory and measured values are compared with those obtained by thermal desorption measurements.

14919 **(DOE/ER/04676—5) Atomic and molecular sciences. Progress report No. 7, April 1, 1980-March 31, 1981.** Walters, G.K.; Lane, N.F. (Rice Univ., Houston, TX (USA). Dept. of Physics). 1980. Contract AS05-76ER04676. 47p. NTIS, PC A03/MF A01.

The atomic and molecular physics program at Rice University addresses fundamental problems in structure, radiation-induced gas- and condensed-phase reaction kinetics and dynamics, and the mutual interactions of radiation, atoms, molecules, electrons and ions, particularly in highly unusual or exotic environments. The program emphasizes fundamental studies relating to new sources of energy, with close interaction between experimental and theoretical aspects of the research. Progress in the experimental program is reported in three principal areas, A) gaseous electronics, B) spin-polarized He^+ and $He(2^3S)$ beams for probing atom- and molecule-surface interactions, and C) surface atomic structure studies by polarized low energy electron diffraction (PLEED).

14920 **(DOE/ER/10609—02) Electron collisions with positive ions. Progress report, April 1, 1980-March 31, 1981.** Henry, R.J.W. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). Nov 1980. Contract AS05-80ER10609. 7p. NTIS, PC A02/MF A01.

Collision strengths for electron impact excitation of the 2s-2p, 2s-3s, and 2p-3s doublets of Li-like O^{5+} were calculated for energies between the 3s and 3p levels, and for excitation of the 2s-2p, 2s-3s, 2s-3p, and 2p-3p doublets for energies between the 3p and 3d levels. Calculations were made in a five-state close-coupling approximation. Autoionization resonances in the scattering collision strengths were included through quantum defect theory analysis. Resonance contributions enhanced the allowed 2p-3s collision

strength by factors of 6.8 and 2.8 in the energy regions, respectively. The forbidden 2s-3s collision strength is enhanced by lesser amounts, by factors of 2.0 and 1.2, respectively. Collision strengths were calculated for Zn^+ from the 4s ground state to excited states 4p, $3d^9\,4s^2$, 5s, and 4d in a five-state close-coupling approximation for the electron impact energy range $15 < E < 400$ eV. Very good agreement with measurements of absolute emission cross sections of Rogers et al. was obtained for the energy range $15 < E < 100$ eV, when cascade contributions were included. A two-state close-coupling approximation was used to calculate inner-shell excitation of Zn^+ for transitions $3d^{10}\,4S \rightarrow 3d^9\,4s5l$. These excitation-autoionization processes were shown to enhance by factor of two, the ionization cross section for Zn^+ in the energy region up to five times the ionization threshold.

14921 **(DOE/ER/10635—T1) Glow discharge as an atomization and ionization device. Progress report, May 1, 1980-February 1, 1981.** Harrison, W.W. (Virginia Univ., Charlottesville (USA). Dept. of Chemistry). 1981. Contract AS05-80ER10635. 9p. NTIS, PC A02/MF A01.

Glow discharge ion sources are discussed, including ion source design, the effect of magnetic fields on discharge operation, influence of magnetic fields on ion sampling, and the disc cathode source. (GHT)

14922 **Formation of hydrogen negative ions by surface and volume processes with application to negative ion source.** Hiskes, J.R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Journal de Physique (Paris), Colloque ;* **2**: No. 7, C7.179-C7.192(1979).

From 14. International conference on phenomena in ionized gases (ICPIG-14); Grenoble, France (9 - 13 Jul 1979).

Three methods for the formation of negative ions are reviewed: double charge-exchange, whereby low-energy positive ions are converted to negative ions by two sequential electron captures in a vapor target; electron-volume-processes wherein low-energy electrons lead to negative-ion formation by dissociative attachment or dissociative recombination by collisions with hydrogen molecules or hydrogen molecular ions and, surface processes leading to negative ions by backscattering or desorption induced by energetic particle bombardment. The application of these methods to the development of hydrogen-negative-ion sources is discussed.

14923 **(PNL-SA—8904) Dynamic screening by projectile electrons in heavy ion collisions.** Toburen, L.H.; Ziem, P.; Stolterfoht, N.; Schneider, D.; Prost, M. (Battelle Pacific Northwest Labs., Richland, WA (USA); Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). Sep 1980. Contract AC06-76RL01830. 16p. (CONF-801111—40). NTIS, PC A02/MF A01.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (Nov 1980).

Anaysis of recent helium and oxygen ion data has shown that the degree of screening of the ion charge can be represented approximately by a model based on the spatial distribution of bound electrons. This screening model is introduced into the binary encounter approximation to account for screening for projectile electrons, and calculated single and double differential cross sections are compared for He^+, He^{2+} ionization of argon and O^{5+} ionization of oxygen. Cross sections for ionization including contributions from both target and projectile are calculated. (GHT)

14924 **(UCID—18712) Effect of re-heating on the hot electron temperature.** Estabrook, K.; Rosen, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jun 1980. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01.

Resonant absorption is the direct conversion of the transverse laser light to longitudinal electron plasma waves (epw) at the critical density [$10^{21}\,(1.06\ \mu m/\lambda_0)^2\ cm^{-3}$]. The oscillating longitudinal electric field of the epw heats the electrons by accelerating them down the density gradient to a temperature of approximately 21T/sub e/$^{0.25}$ ([I(W/cm^2)/10^{16}](λ_0/1.06 μm)^2)$^{0.4}$. This section extends the previous work by studying the effects of magnetic fields and collisions (albedo) which return the heated electrons for further heating. A magnetic field increases their temperature and collisions do not.

14925 **Analytic electron-ion effective potentials for Z< or =55.** Rogers, F.J. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). W-7405-ENG-48. *Physical Review, The, A. General Physics ;* **23**: No. 3, 1008-1014(Mar 1981).

Analytic Z-dependent electron-ion potentials have been obtained for all isoelectronic sequences from He to Cs. These potentials have a parametrized Yukawa component for each electron shell. Parameter values were determined by iteratively solving the Dirac equation until a match with experimental ionization energies was obtained. The screening parameters for each isoelectronic sequence were fit to simple Z-dependent functions. Working systematically through the periodic table and using preceding fits to obtain the screening parameters for closed inner shells, I found it necessary to evaluate only the screening parameter for the valence shell of the parent ion. Excited states having the same parentage as the ground state are also given to good accuracy by these potentials. The energy offset of excited states having a different parentage than the ground state is obtained from simple Z-dependent functions.

14926 **Single- and multiple-electron-loss—cross-section measurements from 20-MeV Fe^{4+} on thin gaseous targets.** Alton, G.D.; Bridwell, L.B.; Lucas, M.; Moak, C.D.; Miller, P.D.; Jones, C.M.; Kessel, Q.C.; Antar, A.A.; Brown, M.D. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1073-1078(Mar 1981).

Single- and multiple-electron-loss cross sections have been measured with 20-MeV Fe^{4+} on thin He, Ne, Ar, Kr, Xe, H_2, N_2, O_2, CH_4, CO_2, CHF_3, CF_4, and SF_6 gaseous targets; cross-section-per-atom data for each system are presented. Cross-section-per-atom data from targets with approximately the same average atomic number indicate that both "nonadditivity" and "density" effects, depending on the final charge state of the ion, play roles in electron-loss processes during projectile interactions with molecular targets. A modified Bohr formula is developed which reproduces single-electron-loss-per-atom data for atomic targets.

14927 **Cross sections for resonant vibrational excitation of N_2 by electron impact.** Hazi, A.U.; Rescigno, T.N.; Kurilla, M. (Theoretical Atomic and Molecular Physics Group, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1089-1099(Mar 1981).

We report the results of a theoretical study of resonant vibrational-excitation of N_2 by low-energy electrons. The vibrational-excitation cross sections were calculated using ab initio fixed-nuclei resonance parameters in the complex-potential or "boomerang" model of Dube and Herzenberg. The electronic resonance energy and decay width were extracted from several ab initio calculations of the ^{2}Pi/sub g/ shape resonance of N_2/sup ts-/. The good agreement between the present cross sections and those obtained recently with the R-matrix technique indicates that the assumptions underlying the complex-potential model are valid for the case of N_2/sup ts-/(^{2}Pi/sub g/). The present results also show the sensitivity of the computed vibrational-excitation cross sections to the fixed-nuclei resonance parameters employed in the calculations. The differential vibrational-excitation cross sections at 90° and the total integrated cross section which we have obtained agree reasonably well with the available experimental data.

14928 **Collision broadening and shift of the potassium 4P-7S and 4P-5D lines by argon.** Hohimer, J.P. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1110-1114(Mar 1981).

A two-step laser excitation technique has been used to investigate the collisional broadening and shift of excited-state potassium transitions. Values for the argon collisional broadening and shift constants for the potassium 4p-7s and 4p-5d transitions were determined from line shapes for argon pressures up to 100 Torr. The values of these constants (in units of 10^{-9} rad s^{-1} atom^{-1} cm^3) are (4P/sub 1/2/-7S/sub 1/2/): $\gamma = 11.60 \pm 0.07$, $\beta = -6.68 \pm 0.11$; (4P/sub 3/2/-7S/sub 1/2/): $\gamma = 11.49 \pm 0.15$, $\beta = -6.82 \pm 0.14$; (4P/sub 1/2/-5D/sub 3/2/): $\gamma = 8.64 \pm 0.07$, $\beta = -4.62 \pm 0.04$;

(4P/sub 3/2/-5D/sub 3/2/): γ=8.58 +- 0.10, β=-3.49 +- 0.32; (4P/sub 3/2/-5D/sub 5/2/): γ=9.13 +- 0.10, β=-4.73 +- 0.09. These broadening and shift constants are interpreted in terms of a Lennard-Jones interaction potential.

14929 **Generalization of the separable approximation to scattering in the presence of long-range forces.** Rescigno, T.N.; Orel, A.E. (Theoretical Atomic and Molecular Physics Group, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1134-1137(Mar 1981).

We discuss the difficulties inherent in the application of the separable approximation to scattering problems involving long-range forces. We propose a generalization of the usual separable expansion in which the long-range forces are treated exactly and only the short-range exchange forces are projected onto a set of L^2 functions. Application is made to the problems of s-wave electron—hydrogen- and electron—helium-atom scattering in the static-exchange approximation and a model problem involving a long-range ($1/r^3$) potential. In all cases, the separable approximation using distorted waves is found to converge much more rapidly than the standard separable expansion.

14930 **Search for long-lived 2S muonic hydrogen in H_2 gas.** Egan, P.O.; Dhawan, S.; Hughes, V.W.; Lu, D.C.; Mariam, F.G.; Souder, P.A.; Vetter, J.; zu Putlitz, G.; Thompson, P.A.; Denison, A.B. (J. W. Gibbs Laboratory, Yale University, New Haven, Connecticut 06520). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1152-1163(Mar 1981).

We have searched for long-lived 2S muonic hydrogen (μ^-p) in H_2 gas at 0.8 atm. The state could be detected by observing delayed 1.9-keV 2P→1S photons from collisionally quenched μ^-p(2S). The observed upper limit (90% confidence level) for the fraction, f/sub 2S/, of μ^-p(2S) with lifetime tau/sub 2S/ in the gas in the range, 100<tau/sub 2S/<1000 ns, is f/sub 2S/<2%. Our results are consistent with the view that most of the μ^-p(2S) have kinetic energies greater than the 0.3-eV threshold for the inelastic collision $\mu^-p(2S)+H_2\rightarrow\mu^-p(2P)+H_2$ and hence are rapidly quenched. We have also measured the relative Lyman line intensities in muonic hydrogen and muonic helium at 0.8 atm with solid-state detectors [Ge for μ^- ^{4}He and Si(Li) for μ^-p]. The results are (K/sub α//K/sub total/)/sub mu-p/=0.46 +- 0.06, K/sub α//K/sub total/)/sub mu-ts4He/=0.76 +- 0.04, (K/sub β//K/sub total/)/sub mu-ts4He/=0.04 +- 0.02. These results imply that about 7.5% of μ^-p atoms cascade to the 2S state.

14931 **Initial-state relaxation effects in molecular Auger spectra.** Jennison, D.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review, The, A. General Physics ;* **23**: No. 3, 1215-1222(Mar 1981).

The initial-state valence relaxation of the molecular orbitals to the presence of the core hole is found to have a significant effect upon the core-valence-valence Auger decay probabilities and hence upon the Auger line shape. Comparisons are made of experimental and theoretical line shapes of ammonia and ethane. The best theoretical amplitudes were calculated by using self-consistent initial-state molecular orbitals which were projected upon the final states. The use of explicit initial-state orbitals leads to significant improvement over a simpler approach consisting of the use of minimum basis set ground-state orbitals and atomic Auger matrix elements.

14932 **Coherent atomic deflection by resonant standing waves.** Bernhardt, A.F.; Shore, B.W. (Lawrence Livermore National Laboratory, P. O. Box 5508, Livermore, California 94550). W-7405-ENG-48. *Physical Review, The, A. General Physics ;* **23**: No. 3, 1290-1301(Mar 1981).

We extend the previous theoretical treatment of standing-wave deflection of two-level atoms to include nonresonant excitation, nonorthogonal laser and atomic beams, and excitation duration upper bounded only by atomic relaxation times. Numerically solving equations analogous to those of abruptly initiated multilevel atomic excitation, we find bounds on the maximum deflection fixed by balancing acquired kinetic energy against interaction energy. We find that frequency detuning or nonorthogonal orientation of laser and atomic beams can enhance the deflection and, given sufficiently long interaction time, one can observe deflections at larger discrete angles. We comment on the connection between these Bragg scatterings and multiphoton resonances.

14933 **Negative ion losses in magnetically insulated vacuum gaps.** VanDevender, J.P.; Stinnett, R.W.; Anderson, R.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-DP00789. *Applied Physics Letters ;* **38**: No. 4, 229-231(15 Feb 1981).

Negative ion losses have been observed in a long, self-magnetically insulated transmission line after the electrons are insulated. Time of flight spectra are consistent with H^-, H_2^-, O_2^-, C_2^-, and heavier molecular ions with energies corresponding to the full anode-cathode potential difference. The negative ion current density J/sub i/ is a sensitive function of the conditions under which the cathode plasma is produced.

14934 **J/sub z/-preserving propensities in molecular collisions. I. Quantal coupled states and classical impulsive approximations.** Khare, V.; Kouri, D.J.; Hoffman, D.K. (Departments of Chemistry and Physics, University of Houston Central Campus, Houston, Texas 77004). *Journal of Chemical Physics, The ;* **74**: No. 4, 2275-2286(15 Feb 1981).

The occurrence of j/sub z/-preserving propensities in atom—linear molecule collisions is considered within the contexts of the quantum mechanical CS approximation and of a classical model collision system. The latter involves an impulsive interaction which is the extreme limit of the class of potentials for which the CS approximation is expected to be valid. The classical model results in exact conservation of j/sub z/ along a "kinematic apse." Quantum mechanically, the CS approximation is reformulated in a manner that clearly shows the relationship between the l choice and the degree and direction of j/sub z/ preservation. Away from the forward direction, the simplest choice obeying time reversal symmetry l=(l-script+l')/2, is shown to result in a propensity for preserving j/sub z/ along a "geometric apse" which coincides with the kinematic apse in the energy sudden limit, and for nonenergy sudden systems only differs significantly from it close to the forward direction.

14935 **Peak power dependence of rovibronic populations below the quasicontinuum during IR multiphoton absorption.** Brenner, D.M. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics, The ;* **74**: No. 4, 2293-2303(15 Feb 1981).

Rovibronic levels of the ground state of thiophosgene, perturbed by IR multiphoton absorption, are observed under collisionless conditions by laser-induced fluorescence. Evidence is presented that at peak powers of the CO_2 laser>3 MW/cm^2 an energy distribution is produced in which the vibrational populations of levels v=0—4,6,8 of the mode ν_4 are depleted or not populated, even though the pumped mode is $2\nu_4$. Only at lower peak powers (longer pulse duration) are population increases observed. Under the latter conditions, it appears that $3\nu_4$ is populated to a smaller extent than $[\nu_1+\nu_3]$ to which it is coupled by strong Coriolis interaction. At room temperature no evidence for rotational "hole burning" effects during IR pumping are observed in the vibrationless level. The data suggest, in fact, that all rotational levels interact with the laser field, even when thiophosgene is rotationally cooled.

14936 **Near thermal charge transfer between Ar^{+2} and N_2.** Holzscheiter, H.M.; Church, D.A. (Physics Department, Texas A&M University, College Station, Texas 77843). *Journal of Chemical Physics, The ;* **74**: No. 4, 2313-2318(15 Feb 1981).

The near thermal charge transfer reaction of Ar^{+2} with N_2 has been studied at total pressures below 10^{-7} Torr using a stored ion technique. Ar^{+2} ions produced by electron impact double ionization of Ar gas were selectively stored for times the order of seconds in a split-ring Penning-type ion trap. The decay with time of the initial ion sample number in a mixture of Ar and N_2 gases was fit to the sum of two exponentials, corresponding to different reaction rates for the ^{3}P and ^{1}D low-lying Ar^{+2} levels. The observed Ar^{+2} number decrease is attributed to the double-charge transfer process $Ar^{+2}+N_2\rightarrow Ar+N_2^{+2}\rightarrow Ar+N^++N^+$ in accord with

recent flow-tube measurements. A rate constant for the metastable $Ar^{+2}(^1D)$ level reaction with a value $k(^1D)=1.4 \times 10^{-9}$ cm³/sec is obtained, using the previously measured rate constant for the $Ar^{+2}(^3P)$ state.

14937 Angular dependence of scattered electron spectra of neon and argon in the region of quasidiscrete autoionizing states. Dillon, M.A.; Spence, D. (Argonne National Laboratory, Argonne, Illinois 60439). W-31-109-ENG-38. *Journal of Chemical Physics, The ;* **74**: No. 4, 2654-2655(15 Feb 1981).

Using 200 eV incident electrons, the energy-loss spectra is measured for e-Ar and e-Ne collisions. It is demonstrated that information on quasi-discrete autoionizing states can be obtained via the Born approximation.(AIP)

14938 Propensity for preserving polarization in rotationally inelastic molecular collisions. Khare, V.; Kouri, D.J.; Hoffman, D.K. (Department of Chemistry and Department of Physics, University of Houston, Central Campus, Houston, Texas 77004). W-7405-ENG-82. *Journal of Chemical Physics, The ;* **74**: No. 4, 2656-2657(15 Feb 1981).

The CS approximation is employed to calculate scattering amplitudes for He—CO, Ne—HD, and He—H_2 collisions.(AIP)

14939 Self-magnetically insulated ion diode. VanDevender, J.; Quintenz, J.; Leeper, R.; Johnson, D.; Crow, J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789. *Journal of Applied Physics ;* **52**: No. 1, 4-12(Jan 1981).

Light ion diodes for producing 1—100 TW ion beams are required for inertial confinement fusion. The theory, numerical simulations, and experiments on a self-magnetically insulated ion diode are presented. The treatment is from the point of view of a self-magnetically insulated transmission line with an ion loss current and differs from the usual treatment of the pinched electron beam diode. The simulations show that the ratio $V/IZ_0=0.25$ in such a structure with voltage V, local total current I, and local vacuum wave impedance Z_0. The ion current density is enhanced by a factor of approximately 2 over the simple space-charge limited value. The simulation results are verified in an experiment. An analytical theory is then presented for scaling the results to produce a focused beam of protons with a power of up to 10^{13} W.

14940 Laboratory EXAFS facilities-1980. Stern, E.A. (ed.). New York, NY; American Institute of Physics (1980). 176p. (CONF-800487—).

From Workshop on laboratory EXAFS sources; Seattle, WA, USA (28 Apr 1980).

Individual abstracts were prepared for the papers given at this conference. One of these papers has already been cited in ERA, and may be located by reference to the entry CONF-800487--1 in the Report Number Index. The remaining papers will be added to the data base when they are received on tape from AIP. (RWR)

6450 High Energy Physics

REFER ALSO TO CITATION(S) 15007

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 14909, 14958, 14962, 14965

14941 (ANL-HEP-CP—80-14) Physics with polarized beams above GeV region. Yokosawa, A. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 13p. (CONF-800374—12). NTIS, PC A02/MF A01.

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

During the past several years many exciting and unexpected results have been observed in experiments with polarized beams. Those results are reviewed briefly. A new polarized beam line up to 600 GeV/c is also discussed. 4 figures.

14942 (ANL-HEP-CP—80-33) Properties of the ωp resonance at 1.8 GeV observed in p polarized p→ pωp at 11.75 GeV/c. Arenton, M.W.; Ayres, D.S.; Diebold, R.; May, E.N.; Nodulman, L.; Sauer, J.R.; Wicklund, A.B. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 13p. (CONF-800724—66). NTIS, PC A02/MF A01.

From 20. international conference on high energy physics; Madison, WI, USA (17 Jul 1980).

Preliminary results from a sample of ~ 20,000 events of the reaction pp→pωp obtained using the ZGS 11.75-GeV/c polarized proton beam and the Effective Mass Spectrometer are presented. An enhancement in the ωp mass distribution with mass 1.810 +- 0.025 GeV and width 0.140 +- 0.040 GeV is observed. The t distribution of this enhancement shows a pronounced dip near $-t = 0.2$ GeV²; this dip suggests that the production mechanism is mostly ω-exchange. The decay angular distributions are consistent with a spin-parity of 2^{+-}. 4 figures.

14943 (LA—8659-T) Forward angle quasi-free proton-neutron analyzing powers at 0.8 GeV. Barlett, M.L. (Los Alamos Scientific Lab., NM (USA)). Jan 1981. Contract W-7405-ENG-36. 146p. NTIS, PC A07/MF A01.

Thesis.

As the first step in determining the nucleon-nucleon scattering amplitudes at small momentum transfers at 0.8 GeV, quasi-free p vector + n and p vector + p analyzing powers were obtained at laboratory scattering angles from 6° to 32.9° by scattering 800-MeV polarized protons from a liquid deuterium target. Forward-scattered protons were detected by the High Resolution Spectrometer (HRS), while recoil neutrons and protons were detected in coincidence with the event detected with the HRS by a 5 x 5 array of scintillators. A thin scintillator placed between the target and the array enabled discrimination of recoil particle type and facilitated the simultaneous measurement of both p vector n and n vector p analyzing powers. A comparison of the results with previously measured free p vector p and n vector p analyzing powers shows excellent agreement between the free and quasi-free p vector p analyzing powers. Poorer agreement is seen for the p vector n analyzing powers. The results of phase-shift analyses are presented in order to study the effects of the quasi-free analyzing power measurements on the determination of the pn scattering amplitudes. Amplitudes obtained from the phase-shift analyses are then used in KMT calculations. The results indicate that further nucleon-nucleon measurements are necessary in order to determine the nucleon-nucleon amplitudes unambiguously at 800 MeV. (29 figures, 6 tables)

14944 (SLAC—235) Study of leading strange meson resonances and spin-orbit splittings in $K^-p \rightarrow K^-\pi^+n$ at 11 GeV/c. Honma, A.K. (Stanford Linear Accelerator Center, CA (USA)). Nov 1980. Contract AC03-76SF00515. 254p. NTIS, PC A12/MF A01.

The results from a high-statistics study of $K\pi$ elastic scattering in the reaction $K^-p \rightarrow K^-\pi^+n$ are presented. The data for this analysis are taken from an 11-GeV/c K^-p experiment performed on the Large Aperture Solenoidal Spectrometer (LASS) facility at the Stanford Linear Accelerator Center (SLAC). By selecting the very forward produced $K^-\pi^+$ events, a sample consisting of data for the $K\pi \rightarrow K\pi$ elastic scattering reaction was extracted. The angular distribution for this meson-meson scattering is studied by use of both a spherical harmonic moments analysis and a partial-wave analysis (PWA). The previously established leading natural spin-parity strange meson resonances (the J/sup P/ = 1^- K*(895), the 2^+ K*(1430), and the 3^- K*(1780)) are observed in the results from both the moments analysis and the PWA. In addition, evidence for a new spin 4^- K* resonance with a mass of 2080 MeV and a width of about 225 MeV is presented. The results from the PWA confirm the existence of a 0^+ κ (1490) and propose the existence of a second scalar meson resonance, the 0^+ κ' (1900). Structure in the P-wave amplitude indicates resonance behavior in the mass region near 1700 MeV. In two of the four ambiguous solutions for the mass region above 1800 MeV, there is strong evidence for another P-wave resonant structure near 2100 MeV. The observed strange meson resonances are found to have a natural interpretation in terms of states predicted by the quark model. In particular, the mass splittings of the leading trajectory natural spin-parity strange

meson states and the mass splittings between the spin-orbit triplet states are discussed. 59 figures, 17 tables.

14945 **Search for narrow p-barp states in the reactions p-barp→p-barpπ^0 and p-barprho^0 at 5 GeV/c.** Chung, S.U.; Fernow, R.; Kirk, H.; Lesnik, A.; Protopopescu, S.D.; Weygand, D.; Bensinger, J.; Kirsch, L.; Morris, W.; Poster, R.; Schmidt, P.; Meadows, B.T.; Albright, J.; Diamond, R.; Fenker, H.; Goldman, J.H.; Hagopian, V.; Jenkins, C.M.; Bar-Yam, Z.; Dowd, J.; Kern, W.; Winik, M. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters ;* **46**: No. 6, 395-397(9 Feb 1981).

A search for narrow p-barp states (width $<$ or $\approx$20 MeV/c^2) has been conducted in the Brookhaven National Laboratory multiparticle spectrometer. No significant structure has been observed in events where the p-barp system has been produced forward in the laboratory. Upper-limit cross sections (95% confidence level) for p-barp masses below 2.2 GeV/c^2 are $<$ or $=$0.12 μb and $<$ or $=$0.22 μb for the final states p-barpπ^0 and p-barprho^0, respectively.

14946 **Study of diquark fragmentation at the CERN intersecting storage rings.** Hanna, D.; DiBitonto, D.; Eickmeyer, J.; Kernan, A.; O'Connor, J.; VanDalen, G.; Wojslaw, R.; Boehm, A.; Giboni, K.L.; Barone, M.; Ceradini, F.; Muller, F.; Naroska, B.; Nussbaum, M.; Rubbia, C.; Irion, J.; Navach, F.; Schinzel, D.; Seebrunner, H.; Staude, A.; Tirler, R.; Voss, R.; Block, M.; Campanini, R. (Harvard University, Cambridge, Massachusetts 02138). *Physical Review Letters ;* **46**: No. 6, 398-401(9 Feb 1981).

Forward particle production in pp interactions triggered by a 30^0 pion of momentum exceeding 5 GeV/c has been studied at c.m. energy of 63 GeV. Quantum-chromodynamic model calculations show that in a majority of such interactions the incident proton loses a valence quark. Results indicate that hadronization of diquarks in primarily a recombination process leading to the formation of a high-x baryon.

14947 **Lower limit on neutral-heavy-muon mass.** Clark, A.R.; Johnson, K.J.; Kerth, L.T.; Loken, S.C.; Markiewicz, T.W.; Meyers, P.D.; Smith, W.H.; Strovink, M.; Wenzel, W.A.; Johnson, R.P.; Moore, C.; Mugge, M.; Shafer, R.E.; Gollin, G.D.; Shoemaker, F.C.; Surko, P. (Physics Department and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). W-7405-ENG-48;DE-AC02-76ER03072;E4-76-C-02-3000. *Physical Review Letters ;* **46**: No. 5, 299-302(2 Feb 1981).

Analysis of 122 965 dimuon final states produced by 209-GeV muons in a magnetized iron calorimeter has set a lower limit on the mass of a neutral heavy muon (M-bar^0). If the M-bar^0 is coupled with Fermi strength to a right-handed charged current and decays to $\mu\mu\nu$ with a 10% branching ratio, its mass exceeds 9 GeV/c^2.

14948 **Measurement of the branching fraction for the Cabibbo-suppressed decay tau$^-$→K^{*-}(892)ν/sub tau/.** Dorfan, J.M.; Blocker, C.A.; Abrams, G.S. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). DE-AC03-76SF00515; W-7405-ENG-48. *Physical Review Letters ;* **46**: No. 4, 215-218(26 Jan 1981).

This Letter presents a measurement of the branching fraction for the Cabibbo-suppressed decay tau$^-$→K^{*-}(892)ν/sub tau/ using data obtained with the Mark-II detector at SPEAR. Eleven events containing a K^{*+-}(892) in coincidence with a muon or an electron of opposite charge were found in data which span the center-of-mass energy region 4.2$<$E/sub c.m./$<$6.7 GeV. It was determined that B(tau$^-$→K^{*-}(892)ν/sub tau/)1.7=(plus-or-minus0.7)%. The absence of events at the K^{*+-}(1430) yields a 2σ upper limit B(tau$^-$→K^{*-}(1430)ν/sub tau/)$<$0.9%.

14949 **Tau lepton.** Perl, M.L. (Stanford Linear Accelertor Center, Stanford University, Stanford, California 94305). DE-C03-765F00515. *Annual Review of Nuclear Science ;* **30**: No. 1, 299-335(Dec 1980).

The production, identification, decay, and theoretical signif.-cance of the tau lepton are reviewed. (AIP)

14950 **Charmed mesons produced in e$^+$e$^-$ annihilation.** Goldhaber, G.; Wiss, J.E. (Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). W-7405-ENG-48. *Annual Review of Nuclear Science ;* **30**: No. 1, 337-381(Dec 1980).

The production decay modes, spin, and mass of D mesons are reviewed. Properties of the F meson are discussed briefly. (AIP)

14951 (INIS-mf—5797, pp A33-A74) **Studies of π^-p interactions in the Fermilab Hybrid System.** Shephard, W.D. (Notre Dame Univ., IN (USA). Dept. of Physics). [nd].

From 9. international symposium on high energy multiparticle dynamics; Tabor, Czechoslovakia (2 Jul 1978).

π^-p interactions are described at 100 GeV/c, 200 GeV/c, 300 GeV/c observed with the Fermilab hybrid system composed of the 30-inch bubble chamber together with downstream wide-gap optical spark chambers. The system allowed studying a variety of aspects of hadronic interactions, mainly the quark-parton structure of hadrons; energy dependence of two charged particle rapidity correlations; three-particle rapidity correlations; diffraction dissociation cross sections as a function of charge multiplicity; rho^0 production as a function of energy and Δ^{++} production as a function of energy. The results of the studies are summarized.

6452 Particle Interactions And Properties - Theoretical

14952 **(ANL-HEP-CP—80-24) Issues in massive lepton pair production in hadronic interactions, 1980.** Berger, E.L. (Argonne National Lab., IL (USA)). Apr 1980. Contract W-31-109-ENG-38. 44p. (CONF-800374—11). NTIS, PC A03/MF A01.

From 15. Rencontre de Moriond; Les Arcs, France (9 Mar 1980).

A discussion is presented of issues of current importance in the theory and phenomenology of massive lepton pair production in hadronic interactions. The relevance of higher-twist inverse-power terms for all constituent scattering processes is emphasized. 7 figures.

14953 **(ANL-HEP-PR—80-48) Magnetic moments of composite quarks and leptons: further difficulties.** Lipkin, H.J. (Argonne National Lab., IL (USA)). May 1980. Contract W-31-109-ENG-38. 9p. (CONF-800724—64). NTIS, PC A02/MF A01.

From 20. international conference on high energy physics; Madison, WI, USA (17 Jul 1980).

The previously noted difficulty of obtaining Dirac magnetic moments in composite models with two basic building blocks having different charges is combined with the observation by Shaw et al., that a light bound fermion state built from heavy constituents must have the Dirac moment in a renormalizable theory. The new constraint on any model that builds leptons from two fundamental fields bound by non-electromagnetic forces is that the ratio of the magnetic moment to the total charge of the bound state is independent of the values of the charges of the constituents; e.g., such a bound state of a spin-1/2 fermion and a scalar boson will have the same magnetic moment if the fermion is neutral and the boson has charge -e or vice versa.

14954 **(ANL-HEP-PR—80-49) Diffractive photoproduction of strangeness and charm: overlap of QCD and Regge models.** Roy, D.P. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 20p. (CONF-800724—63). NTIS, PC A02/MF A01.

From 20. international conference on high energy physics; Madison, WI, USA (17 Jul 1980).

An overlap between the perturbative QCD and Regge models for the diffractive photoproduction of strangeness and possibly charm is suggested and supported by explicit comparison between the model predictions. Some of the QCD model parameters are estimated—most notably the gluon x distribution over the region 0 $\leqq$ x $\leqq$. 0.1. 4 figures

14955 (FERMILAB-Pub—80/54-THY) Short range correlations and baryon decay. Karl, G.; Lipkin, H.J. (Argonne National Lab., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1980. Contract W-31-109-ENG-38;AC02-76CH03000. 12p. (ANL-HEP-CP—80-41; CONF-800724—65). NTIS, PC A02/MF A01.

From 20. international conference on high energy physics; Madison, WI, USA (17 Jul 1980).

Hyperfine interactions break SU_6 symmetry in the short range correlations between quarks and thereby give significant corrections to branching ratios for proton decay from values computed into the SU_6 invariant limit.

6453 Particle Invariance Principles And Symmetries

14956 (ANL-HEP-CP—80-44) Why is B-L conserved and baryon number not in unified models of quarks and leptons. Lipkin, H.J. (Argonne National Lab., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1980. Contract W-31-109-ENG-38. 10p. (CONF-800724—67). NTIS, PC A02/MF A01.

From 20. international conference on high energy physics; Madison, WI, USA (17 Jul 1980).

Conservation of B-L and nonconservation of B are shown to follow simply from the weak isospin properties of quarks and leptons; namely that left-handed particles and right-handed antiparticles have weak isospin 1/2, that all other fermions are singlets, and that particles with half-integral isospin can only be created or annihilated in pairs.

14957 (ANL-HEP-CP—80-65) SU(5) without SU(5): why B-L is conserved and baryon number not in unified models of quarks and leptons. Lipkin, H.J. (Argonne National Lab., IL (USA)). Sep 1980. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01.

Quark-lepton unification is examined without assuming higher symmetries on more general gauge theories. In particular, properties are sought which are generally attributed to SU(5) models which are already present without the assumption of SU(5). (GHT)

14958 Parity non-conserving electron-nucleon interaction. Commins, E.D.; Bucksbaum, P.H. (Department of Physics, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Annual Review of Nuclear Science ;* **30**: No. 1, 1-52(Dec 1980).

Parity violation is discussed in terms of the Weinberg-Salam model. The theory is compared to results obtained by the SLAC polarized electron-nucleon scattering experiment and by optical rotation experiments for atomic H, Cs, Bi, and Tl. (AiP)

6454 Field Theory

14959 (RLO—1388-840) Perturbative QCD at finite temperature and density: a brief technical review. McLerran, L. (Washington Univ., Seattle (USA). Dept. of Physics). Dec 1980. Contract AC06-76ERO1388. 16p. (CONF-800895—1). NTIS, PC A02/MF A01.

From International symposium on statistical mechanics of quarks and hadrons; Bielefeld, F.R. Germany (24 Aug 1980).

The methods and results of perturbative calculations of the thermodynamic parameters that characterize a finite temperature and density quark-gluon gas are reviewed. The problems which arise in such calculations are outlined. No attempt is made to discuss the calculation of non-perturbative effects in this paper; problems that arise in treating such effects are discussed in other talks.

65 PHYSICS RESEARCH

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 14597, 15006, 15007

14960 (UCRL—50400(Vol.23)) ENSL and CDRL: evaluated nuclear structure libraries. Howerton, R.J. (Lawrence Livermore National Lab., CA (USA)). 2 Feb 1981. Contract W-7405-ENG-48. 11p. NTIS, PC E02/MF $4.70.

Includes 18 sheets of 48 reduction microfiche.

Two files of nuclear structure data derived largely from the seventh edition of the Table of Isotopes are described. The files are computer oriented, and have been constructed so that every decay can be traced either to an eventual ground state or to a positive flag that indicates nothing is known about further decay. 1 table.

14961 Significance of Lagrange multipliers in cross-section adjustment. Wagschal, J.J.; Yeivin, Y. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 776--777(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

6512 Nuclear Properties And Reactions, A=1-5

14962 (LA—8662-T) Elastic scattering of polarized deuterons from hydrogen at 2.0, 1.6, and 1.2 GeV and search for critical opalescence in inelastic scattering of protons from carbon-12 at 800 MeV. Haji-Saeid, S.M. (Los Alamos Scientific Lab., NM (USA)). Jan 1981. Contract W-7405-ENG-36. 232p. NTIS, PC A11/MF A01.

Thesis.

Large deuteron vector and tensor asymmetries were measured for the first time at intermediate energies. The polarized deuteron beam (with tensor and vector components of 0.75 and 0.25, respectively) was used at energies of 2.0, 1.6, and 1.2 GeV. The tensor and vector quantities P/sub yy/ and P/sub y/ were extracted from the data obtained within beam polarization normal to the scattering plane, and P/sub xx/ was obtained when the polarization was precessed into the scattering plane. Analysis of the data using multiple scattering theory demonstrates the importance of the noneikona correction to the Glauber Model and also the sensitivity of the data to double-spin flip components of the NN amplitudes. The differential cross section for the $^{12}C(p,p')^{12}C^*$ (15.11 MeV, 1^+, $T=1$) reaction was measured at 800 MeV; the range of the angular distribution corresponds to momentum transfers of 0.7 to 2.4 fm^{-1} (1 to 3.3 m/sub π/). The cross section decreases almost exponentially at large angles; no maximum is observed in the region where nuclear critical opalescence might be expected. Cross sections measured in parallel to the 15.11-MeV state were for the levels at 11.83 (2^-), 12.71 (1^+), 13.35 (2^-), 16.1 (2^+), and 16.58 (2^-) MeV. 86 figures 18 tables.

14963 Coupled-channels treatment of the positive-parity resonances in ^{4}He. Ramavataram, S. (Oak Ridge National Lab., TN (USA)); Do Dang, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique Theorique et Hautes Energies). *Zeitschrift fuer Physik, A. Atoms and Nuclei ;* **298**: No. 3, 225-234(1980).

The coupled-channels formalism, which has been previously applied successfully to interpret the negative-parity resonances in ^{4}He, has now been extended to the positive-parity $2\hbar\omega$ resonances in this system. The 1p-1h approach has been modified to include coupling to the 2p-2h configurations, which also belong to $2\hbar\omega$ excitations, by using the effective operator formalism. The effect of the Pauli term in the s-wave channel is examined and is found to be important in reproducing the 0^+, $T = 0$ resonance energy and width. Resonances with spins up to J/sup π/ = 3^+ have been studied, and the agreement with available data is satisfactory. In particular, from the good fit to the asymmetry coefficient β(E), one establishes the presence of a 2^+, $T = 0$ resonance around 35-MeV excitation in the system.

14964 **Kinematically incomplete three-nucleon breakup reaction ^{1}H(d, p)pn at 16 MeV.** Correll, F.D.; Ohlsen, G.G.; Brown, R.E.; Hardekopf, R.A.; Jarmie, N.; Doleschall, P. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 960-967(Mar 1981).

We have measured the analyzing powers A/sub y/, A/sub x/x, A/sub y/y, and A/sub x/z for the kinematically incomplete three-nucleon breakup reaction ^{1}H(d,p)pn at a deuteron bombarding energy of 16.0 MeV. Similar data for the elastic channel were obtained at the same time. Data were acquired at laboratory angles from 15.0° to 42.5°. The detected proton continua extended over a range in excitation energy E* for the residual pn system, and this range varied from E*=0—2.6 MeV at 15.0° to E*=0—0.2 MeV at 42.5°. The experimental energy resolution was about 150 keV (lab). The breakup tensor analyzing powers attain magnitudes as large as about 0.2 at the lowest excitation energies. Faddeev calculations have been performed for a variety of final-state configurations having E*=0 and 200 keV and indicate that a full kinematically incomplete calculation would probably show no major disagreement with the data.

14965 **Polarization analyzing power A(θ) in pp elastic scattering at 796 MeV.** McNaughton, M.W.; Bevington, P.R.; Willard, H.B.; Winkelmann, i.; Chamberlin, E.P.; Cverna, F.H.; King, N.S.P.; Willmes, H. (copyright-signase Western Reserve University, Cleveland, Ohio 44106). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1128-1133(Mar 1981).

High precision data have been obtained for the polarization analyzing power A(θ) in pp elastic scattering from 12 to 43° c.m. at 796 MeV. These data extend the angular range of data previously published by this group. Data at 428 MeV have also been obtained and are in agreement with recent double scattering data.

6513 Nuclear Properties And Reactions, A=6-19

14966 **(SAND—80-2516C) Proton current measurements using the prompt gamma ray diagnostic technique.** Leeper, R.J.; Burns, E.J.T.; Johnson, D.J.; McMurtry, W.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 9p. (CONF-810325—2). NTIS, PC A02/MF A01.

From Workshop on measurement of electrical quantities in pulsed power systems; Boulder, CO, USA (2 Mar 1981).

Prompt gamma ray signals from the nuclear reaction ^{7}Li(p,γ)^{8}Be have been used to make time resolved proton current measurements. In these measurements, the proton beam was allowed to strike cylindrical thick lithium metal targets. The time integrated proton current was measured using gamma activation of copper via the reaction ^{63}Cu(γ,n)^{62} Cu(β+). The positron activity of the copper sample was easily measured using coincidence counting techniques. The number of ^{62}Cu atoms produced per proton incident on a thick Li metal target was determined with separate calibration runs performed on the Sandia 2.5 MeV Van de Graaff accelerator. The time history of the prompt gamma production was measured using six EGG NPM-54 scintillator photomultiplier combinations shielded by 96.5 cm of concrete and 5.1 cm of Pb. The use of six scintillator photomultiplier combinations was necessary to increase the statistical precision of the data. The normalization of the prompt gamma time history data with the total time integrated proton-current measurement yielded the absolute time resolved proton current on target. Data from runs performed on the Sandia Proto I accelerator will be presented.

14967 **Time-dependent Hartree-Fock collisions of ^{16}O+^{93}Nb at E/sub lab/=204 MeV.** Devi, K.R.S.; Strayer, M.R.; Irvine, J.M.; Davies, K.T.R. (W. K. Kellogg Radiation Laboratory, California Institute of Technology, Pasadena, California 91125). W-7405-ENG-26. *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1064-1073(Mar 1981).

Time-dependent Hartree-Fock computations are performed for the ^{16}O+^{93}Nb system at a laboratory bombarding energy of 204 MeV. We employ an approximation in which the components of the wave functions perpendicular to the reaction plane are held constant in time. At this energy the total reaction cross section is comprised of approximately equal amounts of fusion and deep inelastic scattering. Fusion is found for those entrance channel angular momenta between l=31h and l=75h; strongly damped inelastic scattering is found above and below this region. The angular momentum excited in the inelastic fragments is shown to have a different character in the different inelastic branches and this behavior could conceivably be used as a test to experimentally prove or disprove the existence of the fusion window.

14968 **Positive pion-nucleus elastic scattering at 30 and 50 MeV.** Preedom, B.M.; Dam, S.H.; Darden, C.W. III; Edge, R.D.; Malbrough, D.J.; Marks, T.; Burman, R.L.; Hamm, M.; Moinester, M.A.; Redwine, R.P.; Yates, M.A.; Bertrand, F.E.; Cleary, T.P.; Gross, E.E.; Hill, N.W.; Ludemann, C.A.; Blecher, M.; Gotow, K.; Jenkins, D.; Milder, F. (University of South Carolina, Columbia, South Carolina 29208). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1134-1140(Mar 1981).

We present measured angular distributions for π^+-elastic scattering at 30 and 50 MeV from selected targets with A=12 to 208. These angular distributions were analyzed using a phenomenological optical potential of first-order form. The mass dependence of the potential strength parameters displays the isospin dependence expected from the free πN interaction.

14969 **Shell model test of the Porter-Thomas distribution.** Grimes, S.M.; Bloom, S.D. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). W-7405-ENG-48. *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1259-1264(Mar 1981).

Eigenvectors have been calculated for the A=18, 19, 20, 21, and 26 nuclei in an sd shell basis. The decomposition of these states into their shell model components shows, in agreement with other recent work, that this distribution is not a single Gaussian. We find that the largest amplitudes are distributed approximately in a Gaussian fashion. Thus, many experimental measurements should be consistent with the Porter-Thomas predictions. We argue that the non-Gaussian form of the complete distribution can be simply related to the structure of the Hamiltonian.

14970 **Isospin mixing in ^{16}O by use of pion and deuteron probes.** Cusson, R.Y.; Castel, B. (Oak Ridge National Laboratories, Oak Ridge, Tennessee 37830). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1279-1281(Mar 1981).

The theoretical analysis necessary to isolate the effects of nuclear and Coulomb interactions in admixing the three 4$^-$ states at 17.79, 18.98, and 19.80 MeV in ^{16}O is presented. An isospin mixing matrix element of 110 +- 10 keV is determined to be compatible with the recent pion and deuteron induced reaction cross sections.

14971 **Low-energy angular distributions for the ^{12}C(e,π^+)e' reaction.** Sealock, R.M.; Caplan, H.S.; Lolos, G.J.; Haxton, W.C. (Saskatchewan Accelerator Laboratory, University of Saskatchewan, Saskatoon S7N 0W0, Canada). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1293-1296(Mar 1981).

Angular distributions for near threshold electroproduction of positive pions from ^{12}C are reported and compared to theory. These data provide tests of recently developed second-order optical potentials and of the nuclear response to electroproduction in the giant resonance region.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 14969

14972 **Beta decay of ^{24}Al.** Warburton, E.K.; Lister, C.J.; Alburger, D.E.; Olness, J.W. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1242-1253(Mar 1981).

The β^+ decay of ^{24}Al has been studied with a Ge(Li)-NaI(Tl) escape-suppression spectrometer. The number of ^{24}Mg γ transitions observed following ^{24}Al decay has been increased from 19 to 44. Definite new β^+ branches were observed to ^{24}Mg levels at 105 76, 108 21, and 113 14 keV. An enhanced E2 transition from

the 4^+ 9301-keV level to the 2^+ 7349-keV level was sought for and found. A probable 8439→7349 $4^+ \rightarrow 2^+$ transition was also observed. The contribution of these new experimental results to an elucidation of the band structure of ^{24}Mg is discussed.

14973 Selectivity in two-particle exclusive heavy-ion reactions. Betts, R.R.; Clerc, H.; Back, B.B.; Ahmad, I.; Wolf, K.L.; Glagola, B.G. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters ;* **46**: No. 5, 313-316(2 Feb 1981).

A high-resolution study of two-particle exclusive reactions of ^{28}Si+^{28}Si over a wide range of bombarding energy shows interesting selectivity in both the mass and the energy spectra. The mass spectra display an enhanced population of every fourth mass which gives way to an enhancement of every second mass at the higher energies. The energy spectrum of inelastically scattered particles shows a selective population of mutually excited yrast states in both fragments.

6515 Nuclear Properties And Reactions, A=39-58

14974 Spectroscopy in ^{54}Co with the (^{6}Li,^{6}He) reaction. McGrath, R.L.; Geesaman, D.F.; Lee, L.L. Jr.; Noe, J.W.; Thorn, C.E. (Department of Physics, State University of New York, Stony Brook, New York 11794). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1060-1063(Mar 1981).

The ^{54}Fe(^{6}Li,^{6}He)^{54}Co reaction was studied at an incident energy of 40 MeV. The results complement earlier (^{3}He,t) and (p,n) work. If one assumes approximate validity of one-step microscopic selection rules, and that the reaction strongly populates ≃(1f/sub 7/2/)$^{-2}$ states, the results suggest the previously unspecified 3^+, 5^+, and 6^+ states of this configuration lie at 2.285, 2.149, and either 3.085 or 3.128 MeV in ^{54}Co, respectively.

14975 Calculation of neutron cross sections on iron up to 40 MeV. Arthur, E.D.; Young, P.G. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 656-657(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 14968, 14979

14976 (CONF-810127—1) Nuclear moments from heavy-ion inelastic scattering above the Coulomb barrier. Gross, E.E. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01.

From Symposium on nuclear physics; Oaxtepec, Mexico (5 Jan 1981).

Use of appropriate theoretical techniques allows the study of the moments of the nuclear charge distribution to be extended above the Coulomb barrier. The investigation of nuclear moments through analysis of differential cross sections is discussed with the aid of several examples: ^{12}C(70.4 MeV) + ^{144,146}Nd, importance of multistep effects; ^{20}Ne(131 MeV) + ^{208}Pb, large hexadecapole deformation; ^{12}C(78 MeV) + ^{194}Pt, asymmetric rotor model; and ^{22}Ne(93.5 MeV) + ^{126}Te, mutual excitation. 13 figures, 1 table. (RWR)

14977 High spin single-particle states in /sup 152,153/ Er. Horn, D.; Young, G.R.; Lister, C.J.; Baktash, C. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1047-1055(Mar 1981).

A spectroscopic investigation of yrast and near-yrast states in ^{152}Er and ^{153}Er is presented. We report measurements of prompt and delayed excitation functions, γ-γ coincidences, isomeric lifetimes, and γ-ray angular distribution, obtained chiefly from the reactions ^{144}Sm(^{12}C,xn)/sup 152,153/Er using carbon beams of laboratory energy 65—95 MeV. The levels observed extend to a spin of J> or =43/2 and include two long-lived isomers in ^{153}Er. The nuclear structure is discussed in terms of the shell model and compared with the systematic behavior of levels in N=84 and N=85 isotones.

14978 Nuclei at high angular momentum. Diamond, R.M.; Stephens, F.S. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). W-7405-ENG-48. *Annual Review of Nuclear Science ;* **30**: No. 1, 85-157(Dec 1980).

The production and properties of high spin states in intermediate mass nuclei are reviewed. (AIP)

6518 Nuclear Properties And Reactions, A=150-189

14979 (CONF-800452—9) Yrast spectroscopy: status of yrast isomers, oblate shapes and feeding of yrast states. Khoo, T.L. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01.

From International conference on nuclear behavior at high angular momentum; Strassbourg, France (22 Apr 1980).

The properties of very-high-spin states at the yrast line are addressed. Three different but related topics are discussed: the status of yrast isomers (mainly in the A ~ 150 region); the nuclear shape along the yrast line; and the feeding of the yrast states as a function of spin. A recurrent theme is the response of the core to the polarizing effects of a successively increasing number of valence particles and how the investigation of very-high-spin states bears on this problem. 10 figures, 1 table. (RWR)

14980 (CONF-810117—5) Nonequilibrium neutron emission from ^{12}C + ^{158}Gd and ^{13}C + ^{157}Gd reactions. Plasil, F.; Beene, J.R.; Ferguson, R.L. (Oak Ridge National Lab., TN (USA); Georgia State Univ., Atlanta (USA); Vanderbilt Univ., Nashville, TN (USA)). 1981. Contract W-7405-ENG-26. 10p. (CONF-810119—3). NTIS, PC A02/MF A01.

From 9. international workshop on gross properties of nuclei and nuclear excitations; Kleinwalsertal, Austria (Jan 1981).

The energy dependence of nonequilibrium neutron emission (NNE) and the effects of projectile structure were investigated in these reactions between 103 and 160 MeV. Neutron energy spectra and angular distributions were measured. Typical spectra show no projectile structure effect. The absence of difference in NNE between ^{12}C- and ^{13}C-induced reactions was also noted. The Wilczynski model agrees well with the data. 5 figures, 1 table. (RWR)

14981 (LA-tr—81-1) Total gamma ray production cross sections in the interaction of 1- to 10-MeV neutrons with tungsten nuclei. Savin, M.V.; Khoklov, Yu.A.; Paramonova, I.N.; Chirkin, V.A.; Lunin, V.N.; Zalialov, N.N. (Los Alamos Scientific Lab., NM (USA)). Jan 1981. Translated from Neitronnaia fizika. 1977 All Union Conference, Kiev, Volume 2, pp 103-106. 8p. NTIS, PC A02/MF A01.

The measurement results for total gamma-ray production cross sections for the energy E/sub γ/ = 1 to 5 MeV for the (n,xγ) reactions in natural tungsten are described. The measurements were carried out by means of a linear accelerator source and the time-of-flight technique with a time resolution of 1 ns/m. 1 figure, 1 table.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 14968

14982 Energy dependence of ^{209}Bi fragmentation in relativistic nuclear collisions. Aleklett, K.; Morrissey, D.J.; Loveland, W.; McGaughey, P.L.; Seaborg, G.T. (Nuclear Science Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1044-1046(Mar 1981).

The results of cross section measurements for the reactions ^{209}Bi(^{12}C,X)Au, E=4.8 and 25.2 GeV and ^{209}Bi(^{20}Ne,X)Au, E=8.0 GeV are reported. The observed yields of the gold isotopes show a similar dependence on mass number for each reaction, differing slightly in the position of the centroid of the distribution. As

the projectile energy increases, the inferred excitation energy of the primary residues remains the same or decreases slightly. This observation is in agreement with the predictions of the intranuclear cascade model of relativistic heavy ion collisions.

6520 Nuclear Properties And Reactions, A=220 And Above

14983 (EPRI-NP—1704) Neutron total and capture cross section of ^{232}Th from 0.006 to 18 eV. Final report. Little, R.C.; Harris, D.R.; Block, R.C. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering). Feb 1981. 143p. NTIS, PC A07/MF A01.

Transmission measurements were carried out to determine the total cross section by use of high-purity thorium metal and a ^{6}Li-glass scintillation detector. To determine the capture cross section, the relative neutron capture yield was found. Capture events were measured by a 1.25-m-dia liquid scintillator at a flight path of 25.68 m. The relative neutron flux is measured with a $^{10}B_4C$-NaI detector at a flight path of 28.32 m. The measured capture yield is converted to the capture cross section by making corrections for multiple scattering and self-shielding. Both the experimental total and capture cross sections are reproduced significantly better by ENDF/B-V than ENDF/B-IV in the energy region above 0.1 eV. There is substantial agreement in this energy range between the present capture results and the results of a recent measurement at BNL. For neutron energies below 0.1 eV, the cross section measurements are strongly influenced by microcrystalline effects in the samples (the capture data are affected via multiple scattering). The experimental data total cross section increases with decreasing energy less rapidly than the ENDF/B-V evaluated total cross section for energies less than 0.1 eV. Bragg scattering effects are predicted and observed in the total cross section data below about 0.4 eV. 51 figures, 13 tables.

14984 Fission of ^{238}U induced by inelastic scattering of 120 MeV α particles. Back, B.B.; Shotter, A.C.; Symons, T.J.M.; Bice, A.; Gelbke, C.K.; Awes, T.C.; Scott, D.K. (Argonne National Laboratory, Argonne, Illinois 60439). W-31-109-ENG-38. *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1105-1109(Mar 1981).

The fission decay of ^{238}U has been measured as a function of excitation energy in inelastic scattering of 120 MeV α particles. Total kinetic energies and masses of fission fragments were measured by the double energy method. It is observed that the total kinetic energy E/sub K/ decreases and that the valley in the mass distribution is reduced when the excitation energy of the system is increased. No indication of anomalous total kinetic energy release in the region of the giant quadrupole resonance has been found. A qualitative interpretation of the data is given on the basis of a static scission point model.

14985 Delayed neutron yields: Time dependent measurements and a predictive model. Waldo, R.W.; Karam, R.A.; Meyer, R.A. (Nuclear Chemistry Division, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1113-1127(Mar 1981).

The delayed neutrons from neutron-induced fission in ^{232}U, ^{237}Np, ^{238}Pu, ^{241}Am, ^{242}Am/sup m/, ^{245}Cm, and ^{249}Cf were studied for the first time; those from ^{232}Th, ^{233}U, ^{235}U, ^{236}U, ^{239}Pu, ^{241}Pu, and ^{242}Pu were measured again. The data were used to develop an expression for the prediction of the absolute delayed neutron yield, and the prediction of delayed neutron emission with time. This approach accurately predicts observed delayed neutron yields and decay characteristics. A fission product yield model was used in conjunction with delayed neutron emission probability to analytically predict delayed neutron characteristics. The results of this analysis are in excellent agreement with experimental values.

14986 Decay of 14.1-h ^{240}U and 7.22-min ^{240}Np/sup m/. Hseuh, H.; Franz, E.; Haustein, P.E.; Katcoff, S.; Peker, L.K. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1217-1227(Mar 1981).

The γ-ray spectrum of 14.1-h ^{240}U was obtained almost free of interference by the much more intense γ radiation from its ^{240}Np/sup m/ daughter by means of continuous radiochemical separations. Thus 16 new transitions (49.1—299.8 keV) were revealed in addition to the single one at 44.1 keV previously identified, and a tentative decay scheme for ^{240}U is proposed. A detailed study of separated ^{240}Np/sup m/ showed 70 γ transitions whose E/sub γ/ and I/sub γ/ values agree well with previous data, and in addition 29 new transitions were found. The absolute intensity of the 554.6-keV γ-ray transition is (20.6 +- 0.5)%, the ^{240}Np/sup m/ half-life is 7.22 +- 0.02 min, and the fraction decaying by isomeric transition is (0.12 +- 0.01)%. A decay scheme of ^{240}Np/sup m/ is proposed which shows several new levels in ^{240}Pu and some changes in previous I/sup π/ and K/sup π/ assignments. The isomeric state is assigned I/sup π/=1/sup(+), K/sup π/=0/sup(+) with the probable configuration 7/2+ [633]/sub p/, 7/2+ [624]/sub n/.

14987 Energy dependence of the ^{238}U thermal capture cross section. Baumann, N.P. (Savannah River Lab., Aiken, SC); Owais, M. *Transactions of the American Nuclear Society ;* **34**: 767-768(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14988 High-resolution measurement of the ^{231}Pa(n,f) cross section from 0.4 eV to 12 MeV. Plattard, S. (Bruyeres-le-Chatel, Montrouge Cedex, France); Auchampaugh, G.F.; de Saussure, G.; Hill, N.W.; Harvey, J.A.; Perez, R.B. *Transactions of the American Nuclear Society ;* **34**: 768-770(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

14989 Fission reaction in the high-energy proton nucleus collision. Takahashi, H. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 771-772(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 14985

14990 (BNL-NCS—28933) Evaluation methods for neutron cross section standards. Bhat, M.R. (Brookhaven National Lab., Upton, NY (USA)). 1980. Contract AC02-76CH00016. 44p. (CONF-800979—14). NTIS, PC A03/MF A01.

From Workshop on nuclear data evaluation methods and procedures; Upton, NY, USA (22 Sep 1980).

Portions of document are illegible.

Methods used to evaluate the neutron cross section standards are reviewed and their relative merits, assessed. These include phase-shift analysis, R-matrix fit, and a number of other methods by Poenitz, Bhat, Kon'shin and the Bayesian or generalized least-squares procedures. The problems involved in adopting these methods for future cross section standards evaluations are considered, and the prospects for their use, discussed. 115 references, 5 figures, 3 tables.

14991 (LBL—12073) Dependence of rms charge radii on the neutron skin and on deformation. Myers, W.D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jan 1981. Contract W-7405-ENG-48. 6p. (CONF-810119—2). NTIS, PC A02/MF A01.

From 19. international winter meeting on nuclear physics; Bormio, Italy (Jan 1981).

When the measured rms radii of nuclei throughout the periodic table are compared with each other, and the result is plotted in a certain way, there seems to be evidence for significant shell effects. A closer look, however, suggests that the rms radii are predicted quite accurately by the Droplet Model (a macroscopic model that contains provisions for the possible formation of a neutron skin), if proper account is taken of the nuclear deformation. 3 figures. (RWR)

14992 **Entropy generation and hydrodynamic flow in relativistic heavy ion collisions.** Kapusta, J.I.; Strottman, D. (Theoretical Division, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review, The, C. Nuclear Physics ;* **23**: No. 3, 1282-1285(Mar 1981).

The spectra of pions, protons, and deuterons from collisions of Ar on KCl at a beam energy of 800 MeV per nucleon have been computed in a conventional hydrodynamic approach. Extreme softening of the finite temperature form of the nuclear equation of state leads to significant differences in the number of emitted particles of each species, although there is still too little entropy and too few pions produced as compared with experiment.

14993 **Large-scale shell-model calculations.** McGrory, J.B.; Wildenthal, B.H. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). W-7405-ENG-26. *Annual Review of Nuclear Science ;* **30**: No. 1, 383-436(Dec 1980).

The general principles of the shell model are reviewed and calculations are carried out for nuclei in the A=17—39 region with ^{23}Na considered in some detail. (AIP)

14994 **Three lectures on macroscopic aspects of nuclear dynamics.** Swiatecki, W.J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). pp 383-450 of Heavy ion interactions at high energies. Wilkinson, D. Oxford, England; Pergamon Press (1980).

From International school of nuclear physics - heavy ion interactions at high energies; Erice, Italy (26 Mar 1979).

In these lectures the macroscopic aspects of nuclear dynamics were discussed, that is those aspects that come into prominence when the number of nucleons A is large, A >> 1. The first lecture dealt with statics, and methods of treating the potential energy function of nuclear systems were discussed. It was shown that from the potential energy the conservative forces that drive the time evolution of a nuclear configuration can be deduced. The second lecture dealt with dynamical aspects, especially with the nuclear dissipation function, which describes how dissipative frictional forces oppose the conservative driving forces. In the third lecture the kind of dynamics that results from the balance of these forces was outlined and a number of applications to nuclear fission and heavy ion collisions of this 'New Dynamics' were described.

6540 Radiation And Shielding Physics

14995 (IAEA-TECDOC—221, pp 133-137) **Shielding effect of foil covers.** Zijp, W.L.; Nolthenius, H.J.; van der Borg, N.J.C.M. (Stichting Energieonderzoek Centrum Nederland, Petten). 1979.

From Meeting on current status of neutron spectrum unfolding; Oak Ridge, TN, USA (10 Oct 1977).

For neutron spectrum determinations one often irradiates activation detectors in boxes of cadmium, or of another material. Several models for the neutron attenuation in such foil covers are being studied. Preliminary results are presented.

14996 (Juel-Conf—34, pp 83-94) **State-of-the-art of calculating high energy radiation transport and shielding.** Gabriel, T.A. (Oak Ridge National Lab., TN (USA)). Jan 1980.

From Meeting on targets for neutron beam spallation sources; Juelich, F.R. Germany (11 Jan 1980).

In the previous presentation we have just seen a series of problems that need to be solved concerning spallation neutron sources, and it is the purpose of this talk to show what codes can be used to solve these problems. This will also allow us to judge how appropriate any given code is to solve a particular problem.

14997 **(PNL-SA—8290) Delta-ray production in ion-atom collisions.** Wilson, W.E.; Toburen, L.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jul 1980. Contract AC06-76RL01830. 17p. (CONF-800944—6). NTIS, PC A02/MF A01.

From 7. symposium on microdosimetry; Oxford, UK (8 Sep 1980).

The stochastic energy concentrations randomly deposited in submicron volumes in and near the paths of charged particles is needed. Computational methods, especially Monte Carlo methods, required a comprehensive set of basic interaction cross sections for the primary and all secondary radiation products. Of particular importance for high LET radiations are the cross sections for the production of energetic secondary electrons, delta-rays, in primary ionizing events. In this paper, we review the present state of available data on the production of delta-rays by fast positive ions in collision with targets of biological interest. The systematics in the cross sections for proton ionization of molecular targets are discussed, indicating what scaling is possible and summarizing what can be concluded regarding the dependence of the mean delta-ray energies on the chemical makeup of the medium. A comparison of typical data is made with the binary-encounter approximation to illustrate the limitations of this theoretical treatment of the ionization process. A bibliography of relevant published works on this topic is included.

14998 **Evaluation of flux extrapolation models for discrete ordinates shielding analysis.** Tomlinson, E.T. (Union Carbide Corp., Oak Ridge, TN); Rhoades, W.A. *Transactions of the American Nuclear Society ;* **34**: 650-651(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

6550 Medical Physics

REFER ALSO TO CITATION(S) 13449

14999 **(NUREG/CR—1523) SFACTOR: a computer code for calculating dose equivalent to a target organ per microcurie-day residence of a radionuclide in a source organ - supplementary report.** Dunning, D.E. Jr.; Pleasant, J.C.; Killough, G.G. (Oak Ridge National Lab., TN (USA)). Jun 1980. Contract W-7405-ENG-26. 133p. NTIS, PC A07/MF A01.

The report describes a revision of the SFACTOR computer code, which has been developed to estimate the average dose equivalent to each of a specified list of target organs per microcurie-day residence of a radionuclide in source organs in man. Source and target organs of interest are specified in the input data stream, along with nuclear decay information. The SFACTOR code computes components of dose equivalent rate from each type of decay present for a particular radionuclide, including alpha, electron, gamma radiation, and spontaneous fission. The principal refinement to the program is the addition of a method for calculating components of the dose equivalent rate from alpha particles to endosteal cells and red bone marrow from a source in mineral bone. Other details of the calculations remain unchanged. Corrected tabulations of all components of S are provided for an array of 22 source organs and 24 target organs for 19 radionuclides in an adult.

15000 **Dose rates from a bare spent-fuel assembly.** Anderson, D.W. Jr.; Lipner, M.H.; Ravets, J.M. (W-AES, Pittsburgh, PA). *Transactions of the American Nuclear Society ;* **34**: 651-653(1980). (CONF-800609—).

From 10. international symposium on effects of radiation on materials; Savannah, GA, USA (3 Jun 1980).

6560 Solid State Physics

15001 **(DOE/ER/10452—12) Inter-subband optical absorption in an inversion layer on a semiconductor surface in tilted magnetic fields. Progress report, July 1, 1980-June 30, 1981.** O'Connell, R.F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1981. Contract AS05-79ER10459. 8p. NTIS, PC A02/MF A01.

Cyclotron-resonance experiments on inversion layer electrons in Si (001) metal-oxide-semiconductor field-effect transistors (MOSFET's) have produced many surprising and unexplained results. This has motivated the investigation of the use of other magneto-optical phenomena in MOS systems. Emphasis has been on the Faraday rotation effect. The conditions necessary for achieving a null Faraday rotation, as well as a null ellipticity have been exam-

ined. The calculation of θ for the Appel-Overhauser model for the surface space-charge layer in Si has also been studied.

15002 **Effect of a cubic crystal field on the critical behavior of a 3D model with Heisenberg exchange coupling: A high-temperature series investigation.** Ferer, M.; Van Dyke, J.P.; Camp, W.J. (West Virginia University, Morgantown, West Virginia 26506). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 5, 2367-2373(1 Mar 1981).

The effect of a cubic anisotropy on the critical behavior of systems with isotropic exchange coupling has been the subject of many approximate renormalization-group studies with conflicting results for the n=3, Heisenberg case. These studies disagree on the relevance of cubic crystal-field strength, i.e., whether this field induces a crossover from the n=3 isotropic behavior to a distinctive cubic behavior or not. We have derived and analyzed tenth-order, high-temperature susceptibility series for the spin-infinity Heisenberg model with a nearest-neighbor exchange and a crystal field of cubic symmetry for the fcc lattice. The fixed length of the spins significantly affects the form of the series causing many terms to be zero. Analysis of our tenth-order series for fixed values of the cubic field strength v_4 yields an effective susceptibility index which is indistinguishable from the Heisenberg value for $v_4 <$ or $\approx 5J$, J being the exchange constant. Naive analysis of our series for the cubic field derivatives of the susceptibility suggests that the cubic field strength is a relevant variable with an associated crossover exponent phi=0.63 +- 0.10, much larger than the value, phi~0.1, expected from the renormalization-group calculations.

15003 **Scales and scaling in the Kondo model.** Andrei, N.; Lowenstein, J.H. (Department of Physics, New York University, New York, New York 10003). *Physical Review Letters ;* **46**: No. 5, 356-360(2 Feb 1981).

The thermodynamics of the Kondo model is formulated in terms of coupled integral equations and various properties deduced, in particular the scaling property. Then, with definition of the various scales parametrizing various asymptotic regions of the H-T plane, universal numbers are calculated and, in particular, Wilson's result is obtained analytically.

15004 **Current experimental status of CuCl-research.** Chu, C.W. (Univ. of Houston, TX). pp 191-200 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The CuCl-experiments are reviewed. Various possibilities giving rise to a diamagnetic ac susceptibility shift are examined. The current experimental situation on the CuCl research is summarized and evaluated.

15005 **Monte Carlo evidence for inhomogeneous states in the two-dimensional classical Heisenberg model.** Kawabata, C. (IBM Research Lab., San Jose, CA); Bishop, A.R. *Solid State Communications ;* **33**: No. 4, 453-457(1980).

It is emphasized that topologically classifiable, finite energy intrinsic defect states are known analytically for the continuum classical, isotropic, Heisenberg model in two space dimensions both from statistical mechanics and field theory literature. Evidence from Monte Carlo simulations is presented for the existence of these nonlinear, metastable states at low temperatures.

15006 **(AEC-tr—7411/7) Ukrainian Physics Journal.** Translation of *Ukrainskii Fizicheskii Zhurnal (Russian Edition) ;* **17**: No. 7, 1057-1220(Jul 1972). 212p. NTIS, PC A10/MF A01.

A cover-to-cover translation from Russian into English of Vol. 17, No. 7 (July 1972) of Ukrainskii Fizicheskii Zhurnal (Ukrainian Physics Journal) is presented. The plurality of articles are on solid state physics, but papers on nuclear and plasma physics, electrodynamics, and electric discharges appear as well. Articles in scope for the data base were abstracted and indexed from the original-language publication. (RWR)

15007 **(AEC-tr—7411/6) Ukrainian Physics Journal.** Translation of *Ukrainskii Fizicheskii Zhurnal (Russian Edition) ;* **17**: No. 6, 881-1045(Jun 1972). 202p. NTIS, PC A10/MF A01.

A cover-to-cover translation from Russian into English of Vol. 17, No. 6 (June 1972) of Ukrainskii Fizicheskii Zhurnal (Ukrainian Physics Journal) is presented. The plurality of articles are on solid state physics, but nuclear, high energy, and plasma physics are represented as well. Articles in scope for the data base were abstracted and indexed from the original-language publication. (RWR)

15008 **(DOE/ER/05776—6) Spectroscopy of surface adsorbed molecules. Progress report, May 1, 1980-April 30, 1981.** Coleman, R.V. (Virginia Univ., Charlottesville (USA)). [nd]. Contract AS05-78ER05776. 50p. NTIS, PC A03/MF A01.

The program on the inelastic electron tunneling (IETS) study of surface adsorbed molecules has continued with special emphasis on new substrate-electrode combinations and the effects on the IETS spectrum. Initial experiments on doped substrates using photoelectron spectroscopy (ESCA) have been carried out and results show good detection sensitivity for the adsorbed monolayers that are used for the IETS spectroscopy. Experiments on a variety of oxide substrates are underway using ESCA spectroscopy and the development of techniques for making tunnel junctions with these same substrates is progressing. IETS experiments using cooled substrates, rough substrates and preparation techniques that change the amount of coordinated OH on the A1O/sub x/ substrates show strong effects on the IETS mode intensity. These experiments suggest that the detailed molecular adsorption mechanisms are crucial to the IETS intensity. Further studies of these effects will help to expand the usefulness of IETS and can help interpret IETS spectra in terms of surface structure. Further development work on the ESCA-AUGER system is continuing, and full operation is anticipated during the next contract period. All preliminary tests of procedures have been completed and the first series of experiments have shown very promising results.

6561 Superconductivity

REFER ALSO TO CITATION(S) 14412, 14413

15009 **Superconductivity in d- and f-band metals.** Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980). 514p. (CONF-790653—).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Of the papers presented at the conference, 13 were abstracted previously and 46 are included in this issue. Subjects covered include: new superconductors; electronic structure; phonon effects; A-15 systematics; disorder and transport; magnetism and superconductivity; and ternary compounds. (GHT)

15010 **Johnson noise in ideal type-II superconducting films.** Li, P.S.; Clem, J.R. (Ames Laboratory-U. S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter ;* **23**: No. 5, 2209-2218(1 Mar 1981).

The Johnson-noise power spectrum is calculated for an ideal type-II superconducting film containing an array of thermally agitated vortices. The interactions between the vortices are taken into account via a wave-vector-dependent interaction matrix. We develop a theoretical method for the calculation of the voltage produced by a moving vortex in a measuring circuit with leads of finite radii. For a special measuring circuit, only transverse modes contribute to the measured voltage. Below a characteristic frequency determined by the interaction between the vortices, the viscous drag, and the geometry of the measuring circuit, the power spectrum is suppressed. The ac impedance, whose real part is proportional to the Johnson-noise power spectrum, is also calculated.

15011 **d- and f-band superconductivity: some experimental aspects.** Geballe, T.H. (Stanford Univ., CA). pp 1-11 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Nature provides a variety of superconductors in which d- and f-bands play an important role. An attempt is made to identify the major themes of d- and f-band superconductivity. The discussion covers occurrence and variations of T/sub c/, mechanisms and microscopic parameters, intrinsic properties, and experimental idiosynchrasies. 35 references. (GHT)

15012 **Theoretical overview: emphasis on new mechanisms.** Cohen, M.L. (Univ. of California, Berkeley). pp 13-21 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Some non-phonon electron pairing mechanisms involving d-electrons are examined. The electron-hole lattice interaction originally proposed for CuCl is shown to give small T/sub c/ values. Umklapp or intervalley scattering effects can contribute to raise T/sub c/. The demon (acoustic plasmon) mechanism is explored using model dielectric functions. It is shown that the demon mechanism is capable of reducing the repulsive Coulomb interaction and changing the sign of μ^*.

15013 **Working hypothesis.** Matthias, B.T. (Univ. of California, San Diego, La Jolla). pp 23-24 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The behavior of collective phenomena such as superconductivity and magnetism have been well described by theories. In contrast, there are no existing theories that predict the actual materials in which these collective phenomena should occur. At present, the only way to do so is an empirical approach coupled to a more or less sensible working hypothesis. Two of the most recent examples in this direction are given.

15014 **Thin films and metastable phases.** Gavaler, J.R.; Braginski, A.I.; Ashkin, M.; Santhanam, A.T. (Westinghouse R and D Center, Pittsburgh, PA). pp 25-26 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Theoretical and experimental considerations have led to the belief that all high-temperature superconducting phases are inherently unstable. This explains the current interest in growth techniques which might be capable of forming nonequilibrium, metastable phases of potentially high-T/sub c/ superconductors. Among these, attention has centered on techniques which involve growth from the vapor phase, such as sputtering, evaporation, and chemical vapor deposition (CVD). This is undoubtedly the result of the success that these methods have had in preparing Nb_3Ge. At present this compound remains the highest-temperature superconductor known with a maximum onset temperature of 23.6 K. Over the past several years, the preparation of thin films of Nb_3Ge and several other apparently nonequilibrium phases which have high-T/sub c/'s (high-T/sub c/ is defined here as being equal or greater than 15 K) was investigated. In this paper, these results are reviewed and ideas concerning possible mechanisms by which nonequilibrium phases are formed in thin films are presented.

15015 **Superconductivity in the actinides.** Smith, J.L. (Univ. of California, Los Alamos, NM). pp 37-48 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Recent progress has made the pattern of superconductivity in f-band metals clear. Although the concept of valence is unnecessary, considerations of band structures, phonon modes, densities of states, and magnetic effects appear adequate to explain the superconducting properties. The problems of dealing with radioactive superconductors and some current work is reviewed briefly.

15016 **Superconductivity in irradiated palladium.** Stritzker, B. (Inst. fuer Festkoerperforschung, Juelich, Germany). pp 49-55 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

In pure palladium films, evaporated between 4.2 K and 300 K, transitions into the superconducting state up to 3.2 K have been achieved by irradiation at low temperatures with He^+-ions. It is shown that the presence of a special kind of defect produced by the irradiation is a necessary precondition for the occurrence of superconductivity. It is argued that the introduced lattice defects, perhaps agglomerations of vacancies and of Pd atoms at interstitial sites, depress the strong spin fluctuations in crystalline Pd. This paramagnetic behavior is thought to be the reason for the absence of superconductivity in crystalline Pd.

15017 **Characteristics of getter sputtered thin films of Nb_3Ge and multilayered films of Nb_3Ge/Nb_3Ir.** Schmidt, P.H.; Vandenberg, J.M.; Hamm, R.; Rowell, J.M. (Bell Labs., Murray Hill, NJ). pp 57-63 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The stabilization of A15 Nb_3Ge in its high T/sub c/ form is of fundamental interest and also technologically important. One factor, the influence of gaseous impurities, has been discussed for some time by various authors. A second, epitaxial growth, was studied on Nb_3Ir and an improvement of T/sub c/ and phase purification of the Nb_3Ge was observed, although T/sub c/ did not exceed that of single sputtered films prepared by others. Gavaler et al. have reported that impurities near the substrate-film interface expand the A15 cell and suggest that subsequent deposition results in a homoepitaxial growth with cell size decreasing with increasing thickness. This is consistent with the observed increse in T/sub c/ with increasing film thickness. The results of similar experiments using the getter sputtering method of film preparation are reported. Of particular interest was examination of (1) the structural and phase relationships of Nb_3Ge films prepared with and without an A15 underlayer; (2) how variation of film thickness and deposition temperature affected these properties of T/sub c/; and (3) the potential application and usefulness of multilayered films for the stabilization of A15 Nb_3Si.

15018 **Low temperature specific heat of protactinium.** Stewart, G.R. (Los Alamos Scientific Lab., NM); Smith, J.L.; Spirlet, J.C.; Mueller, W. pp 65-70 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The specific heat of a single crystal of protactinium has been measured between 4.9 and 18 K. The coefficient of the electronic term in the specific heat γ is found to be 5.0 +- 0.5 mJ/mole-K^2, agreeing with the trend in the neighboring elements thorium (γ = 4) and uranium (γ = 9 - 12). The question of whether protactinium is a type II superconductor remains unanswered.

15019 **Additive pressure dependence of the superconducting transition temperature by Th-Y alloys.** Huber, J.G. (Tufts Univ., Medford, MA). pp 71-76 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The T/sub c/ at zero pressure of solid solution Th-Y alloys increases with Y concentration from the pure Th value to a maximum at 20 a/o Y and then decreases until disappearing at 70 a/o Y. The application of pressure P depresses the T/sub c/ of pure Th (negative dT/sub c//dP), while for pure Y a T/sub c/ eventually appears with a dT/sub c//dP which is positive.

15020 **Electronic structure of A15 compounds.** Pickett, W.E. (Northwestern Univ., Evanston, IL). pp 77-85 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

For the past twenty-five years compounds with the A15 crystal structure have dominated the class of high temperature superconductors. The crystal structure of an A15 compound A_3B is cubic (space group O/sub h/^{3}). However, the site symmetry (D/sub 2d/) of the A atoms is much lower than cubic, an unusual occurrence in cubic binary compounds. Variations on this theme have supplied the basis of many theoretical models of the anomalous temperature (T) dependence of normal state properties and the low temperature cubic reversible tetragonal structural transformations which accompany high values of T/sub c/ in A15 compounds. In this paper results of self-consistent pseudopotential band structure calculations are used to assess some important aspects of the unique and unusual behavior in A15 compounds: (1) the role of the B atom in determining the overall electronic structure will be shown to be important; (2) the effect of the low site symmetry of the A atom on the charge density and potential will be assessed; and (3) the bonding will be shown to be metallic-covalent with no significant A-B charge transfer.

15021 **Theoretical evidence for an electronically driven isostructural phase transition in fcc lanthanum.** Pickett, W.E. (Northwestern Univ., Evanston, IL); Freeman, A.J.; Koelling, D.D. pp 99-103 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The results of band structure calculations which provide insight into the origin of the unusual behavior of Lanthanum under pressure are presented. The method of band structure calculation is the Linearized Augmented Plane Wave method of Koelling and Arbman in the semi-relativistic approximation. Both the eigenvalues and the charge density have been carried to self-consistency on a grid of 128 k points in the irreducible Brillouin zone. Both the potential and the charge density were allowed to have a general form. (GHT)

15022 **Superconductivity and charge-density waves.** Balseiro, C.A.; Falicov, L.M. (Univ. of California, Berkeley). pp 105-112 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Superconductivity (SC) and charge-density waves (CDW) are the two most well known cases of broken symmetry in a solid which require an effective attractive electron-electron interaction; this is normally provided by a phonon-mediated mechanism. It is therefore to be expected that systems in which CDWs have been experimentally observed exhibit also SC at very low temperatures. The tendencies towards the formation of SC and CDW are to a certain degree opposing one another; while the SC state has infinite conductivity and a Meissner effect, the CDW state, for large enough interactions, produces a semiconductor gap in the spectrum and a non-conducting state. From the microscopic point of view on the other hand the SC state arises from electron-electron coupling into Cooper pairs, the CDW state from electron-hole coupling and charge redistribution: two effects which are in principle independent of one another. The interdependence of SC and CDW states was studied, with particular interest in setting up a model hamiltonian to test both effects on the same footing.

15023 **Anisotropy of electron-phonon interaction and superconducting energy gap in niobium.** Crabtree, G.W. (Argonne National Lab., IL); Dye, D.H.; Karim, D.P.; Ketterson, J.B. pp 113-119 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Data are presented on the anisotropy of the electron phonon coupling in niobium. A quantity $\lambda(k)$ is defined which describes the integration of an electron in a particular k state with the system of all phonons. Through a combination of accurate, complete de Haas-van Alphen measurements and sophisticated band theory, $\lambda(k)$ is derived on all three sheets of the Fermi surface. Furthermore, the anisotropies in $\lambda(k)$ can be related to anisotropies in $\Delta(k)$, so that a rather complete picture of both the electron-phonon interaction and superconductivity is obtained. This represents a new source of information based largely on experiment which is more complete and detailed than that previously available. (GHT)

15024 **Fermi surface of Nb_3Sb: microscopic comparison of theory and experiment.** van Kessel, A.T. (Univ. of Nijmegen, Netherlands); Myron, H.W.; Mueller, F.M.; Arko, A.J.; Crabtree, G.; Fisk, Z. pp 121-130 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

An ab initio band structure calculation of Nb_3Sb is presented which yields a Fermi surface model of this A-15 compound. Direct comparison between the measured dHvA frequencies can be made. The predicted and measured dHvA extremal cross sectional areas shows near perfect agreement for seven sheets of the Fermi surface. This represents the first Fermi surface model of an A-15 compound which shows quantitative agreement with a dHvA measurement.

15025 **Recent calculations of phonon spectra of transition metals and compounds.** Weber, W. (Inst. fuer Angewandte Kernphysik I, Germany). pp 131-142 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

A new formulation of the lattice dynamics is presented, based on the nonorthogonal tight binding scheme. The method is applied for calculations of the phonon dispersion curves in various transition metals and compounds. All anomalous features in the phonon spectra of these crystals are reproduced. The physical origin of the anomalies and their relation to superconductivity are elucidated.

15026 **Current status of experimental tunneling results on niobium.** Bostock, J. (Massachusetts Inst. of Technology, Cambridge); MacVicar, M.L.A.; Arnold, G.B.; Zasadzinski, J.; Wolf, E.L. pp 153-158 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

There has been a high level of interest in the electron-coupled-phonon spectrum (α^2F) of pure niobium, especially since the discovery that nearly structurally perfect single crystal Nb-substrate junctions with niobium oxide barriers, formed either by in situ thermal oxidation or by acid etching techniques, yield anomalous values of λ and μ^*. A recent calculation raises the question of the applicability of this proximity layer model to single crystal Nb-substrate tunneling data. One such proximity analysis is described. (GHT)

15027 **Proximity electron tunneling study of V and V_3Ga.** Zasadzinski, J. (Iowa State Univ., Ames); Schubert, W.K.; Wolf, E.L.; Arnold, G.B. pp 159-164 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Using a new method of Proximity Electron Tunneling Spectroscopy (PETS) the Eliashberg function α^2F(omega) for V and its important A-15 compound V_3Ga have been determined. The results are compared with neutron scattering data.

15028 Elastic neutron diffraction study of transforming and non-transforming single crystal ZrV_2. Bostock, J.; Wong, M.; MacVicar, M.L.A.; Levinson, M. (Massachusetts Inst. of Technology, Cambridge). pp 165-171 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The mosaic spread of single crystal ZrV_2 is unusually narrow, ~ 1' from room temperature to 130K. For non-transforming perfect single crystal the mosaic gradually increases to ~ 1.86' at 4.2K; for transforming, twinned single crystal the room temperature mosaic is maintained to 110K, then increases to 2.76' at 94K when the crystal transforms to a mixed cubic (30%) and rhombohedral state (70%). The onset of the electronic instability (~ 100K) is accompanied by an increase in diffuse scattering background which, for the twinned crystal, peaks at the structural transformation. The electronic instability coupled to the localized lattice stress appears to be the driving mechanism for the transformation.

15029 Frozen phonon calculations for the L(2/3, 2/3, 2/3) phonon of niobium and molybdenum. Harmon, B.N.; Ho, K.M. (Iowa State Univ., Ames). pp 173-179 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Materials with high superconducting transition temperatures frequently exhibit anomalous features in their phonon dispersion curves. The origin of these anomalies and their significance for superconductivity has been the subject of much debate. Two seemingly different models have been proposed to explain these anomalies in terms of the electron-phonon interaction. The first model focuses on real space charge-density distortions (CDD's), while the second emphasizes the states in reciprocal space near the Fermi energy. To test the assumptions in these models and to better understand the details of the electronic response to lattice vibrations in transition metals self-consistent frozen phonon calculations were performed for the (2/3, 2/3, 2/3) phonon in Nb and Mo. Initial results are reported for the CDD's associated with this phonon and discuss the differences between Nb and Mo.

15030 Interrelation between weak itinerant magnetism and superconductivity in some d-band metal compounds. Enz, C.P. (Univ. of Geneva, Switzerland). pp 181-190 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

After review of the properties of the weak itinerant ferromagnets Sc_3In and $ZrZn_2$ an analysis is made of the remarkable effects ascribable to the electron-phonon interaction in $ZrZn_2$ which recently led to the discovery of weak itinerant antiferromagnetism in $TiBe_2$. A recent theoretical attempt to explain the magnetism of $ZrZn_2$ and $TiBe_2$ in terms of Cooper-pairing ideas is described.

15031 Pairing interaction in surface superconductivity. Hanke, W.; Muramatsu, A. (Max-Planck-Institut fuer Festkoerperforschung, Stuttgart, Germany). pp 201-206 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The microscopic expressions for the superconducting parameters are derived for a surface system. The formulation fully takes surface and periodicity induced nonlocality in the electron-phonon interaction and in the Coulomb electron-electron interaction into account. Thus, in contrast to the commonly used jellium models, it is applicable to transition-metals as well as semiconductor surfaces. As an example the exciton mechanism postulated for superconductivity is discussed. It is shown that surface nonlocality, in contrast to local bulk treatments, allows for electron-exciton-electron coupling and thus can induce attractive interaction.

15032 Superconductivity in 2D inhomogeneous NbN films. Wolf, S.A. (Naval Research Lab., Washington, DC); Gubser, D.U.; Feldman, J.L.; Imry, Y. pp 207-213 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

There has been much recent interest in phase transitions in lower dimensional systems. Of particular interest both theoretically and experimentally is the two dimensional superconducting phase transition and whether in fact it occurs at finite temperature. Recently, universal current scaling was reported in the critical region above a 2D superconducting transition in a granular NbN film. This strongly suggested that indeed a phase transition occurred at finite temperature (T/sub cj/) and also provided critical exponents and the experimental scaling function for the transition. In this paper the universal scaling behavior is shown to extend below T/sub cj/ with the constants and exponents that were determined from the data above T/sub cj/.

15033 Exotic pairing in metals: formalism and application to Nb and Pd. Pinski, F.J. (State Univ. of New York, Stoney Brook); Allen, P.B.; Butler, W.H. pp 215-222 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Previous treatments of $l > 0$ pairing assume spherical symmetry, which give large errors in metal like Pd. A general formalism is developed, including the influence of impurities. Calculation of the electron-phonon Γ/sub l5/ (p-wave) coupling constants for Nb and Pd suggest that exotic pairing will be hard to observe in metals.

15034 A-15 compounds and their amorphous counterparts. Tsuei, C.C. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY). pp 233-246 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The A-15 compounds are known to favor the occurrence of high temperature superconductivity (transition temperature T/sub c/ > 15K). The origin of superconductivity in these metals is a subject of much controversy and importance. A useful approach to this problem is to study comparatively the superconducting and normal-state properties of the A-15 superconductors and their amorphous counterparts. Efforts along these lines have yielded some insight into the mechanisms responsible for high temperature superconductivity. It is interesting to note that most high-T/sub c/ A-15 compounds contain one glass-forming element such as Ge, Si or Al and are thus conducive to the formation of a non-crystalline phase. The amorphous (or higher disordered) state of the A-15 compounds can be achieved, for example, by one of the following techniques: (1) sputtering or co-evaporation onto substrates held at relatively low temperatures; (2) particle irradiation; and (3) ion-mixing. It should be mentioned that one can study systematically various properties of an A-15 material as a function of the degree of disordering by varying certain experimental parameters such as the particle fluence in technique. The A-15 phase can also be recovered from the amorphous or highly disordered state by appropriate thermal annealing. A brief review of recent experiments in this area is given with emphasis on Nb_3Ge and V_3Si.

15035 X-ray determination of anharmonicity in V_3Si. Staudenmann, J.L. (Univ. of Missouri, Columbia); Testardi, L.R. pp 247-257 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

X-ray intensities from over 1000 reflections in single crystal V_3Si at 300K, 78K, and 13.5K, previously obtained by one of the authors have been analyzed for anharmonicity when $\sin\Theta/\lambda > 0.7A^{-1}$ where diffraction occurs from core electrons only. At 78K $\langle\mu^2\rangle$ and $\langle\mu^4\rangle$ moments are found for V which are ~ 50% and 500% larger than expected for a harmonic lattice, and

evidence is found for localization of the V atoms off the lattice sites by ~ 0.2A. No evidence of such large anharmonicity is found for Si atoms at all three temperatures.

15036 **Preferred orientation and lattice registry effects of Nb_3Sn diffusion layers.** DeBroux, J.; Diadiuk, V.; Bostock, J.; MacVicar, M.L.A. (Massachusetts Inst. of Technology, Cambridge). pp 259-264 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Nb_3Sn diffusion layers grown on single crystal niobium exhibit physical properties which consistently discriminate between the bcc-(111) orientation substrate and other bcc major symmetry directions. These layers show preferred orientations in their surface region which do not extend into the layer bulk except for the A15-(100) surface texturing, occuring at the Nb-(110). The Nb_3Sn-Nb interface character is distinctly different for the Nb-(111) orientation as compared to other orientations around the niobium crystal circumference.

15037 **Effects of atomic order on the upper critical field and resistivity of A15 superconductors.** Fluekiger, R.; Foner, S.; McNiff, E.J. Jr. (Massachusetts Inst. of Technology, Cambridge). pp 265-271 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Substantial variations in H/sub c2/(T) and p(T) are observed in the A15 type compounds V_3Ga, Mo_3Os, Nb_3Pt and $Nb_3Au_{0.7}Pt_{0.3}$ for different degrees of atomic ordering produced by different heat treatment. The effect of atomic order on H/sub c2/(0) and p(T) varies strongly from system to system.

15038 **Positron annihilation experiment on V_3Si.** Manuel, A.A.; Samoilov, S.; Sachot, R.; Descouts, P.; Peter, M. (Geneva Univ., Switzerland). pp 273-280 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The A-15 intermetallic compound V_3Si belongs to the class of materials characterized by a high T/sub c/ (17.1°K) and anomalies in other electronic properties. Its band structure is complicated because of the large number of atoms per unit cell, yielding 38 conduction electrons. The common feature to all band structure calculations is the presence of very flat 3d bands in the close vicinity of the Fermi level. Therefore, experiments in which k dependent properties are measured, are needed for the accurate determination of the band structure. A positron annihilation measurement is such an experiment. This measurement is described.

15039 **Studies of the Fermi surface of V_3Si by 2d acar measurements.** Berko, S.; Farmer, W.S.; Sinclair, F. (Brandeis Univ., Waltham, MA). pp 281-289 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Using a two-dimensional angular correlation of annihilation radiation apparatus, projections of the electronic momentum distribution of V_3Si (sampled by a thermalized positron) have been obtained. The three dimensional momentum distribution is reconstructed, and a zone-folding technique yields the density in the reduced zone p(k), which reflects the gross features of the Fermi surface. Nested cylindrical hole surfaces along the edges of the zone that join at the corner points R are observed, and also additional electron density on the zone faces centered about X. Comparisons are made to recent APW calculations.

15040 **Theory of resistivity saturation.** Allen, P.B. (State Univ. of New York, Stoney Brook). pp 291-304 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

High T/sub c/ superconductors at room temperature and above have resistivities rising less rapidly with T than Bloch-Grueneisen theory predicts. Critical discussion of seven possible mechanisms is given. Three mechanisms (anharmonicity, Fermi smearing, T-dependent energy bands) are consistent with Boltzmann theory, and four (localization, Debye-Waller effects, Phonon drag and ineffectiveness, and non-classical conduction channels) are not. It is argued that the last mechanism is the most plausible.

15041 **Resistivity of A15 compounds.** Gurvitch, M. (Brookhaven National Lab., Upton, NY). pp 317-334 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

There is more to A15s than high critical fields and transition temperatures. In particular, resistivity studies of A15s, although related to superconducting properties, have a life of their own. As it is well known, most properties of A15s are rather anomalous, and so is the resistivity. Yet anomalous as it appears when compared to normal, well-behaved metals, the form of the resistivity of A15s is not unique to these compounds. In fact both high temperature saturation of the resistivity curve p(T) and low temperature proportionality to T^2 are found in other systems, as will be discussed below. Hence there is a need for sufficiently general explanations. At present the behavior of p(T) at high temperatures is understood better than at low temperature.

15042 **Transport properties, electronic density of states and T/sub c/ in disordered A15 compounds.** Mueller, P. (Physikalisches Inst. der Universitaet, Erlangen, Germany); Ischenko, G.; Adrian, H.; Bieger, J.; Lehmann, M.; Haase, E.L. pp 369-379 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The emphasis of this work is the investigation of the effects of defects in order to check the idea of universal behavior of A15 compounds and their transition into the metallic glass phase at high degrees of disorder. The main point of interest is not the study of defect structures, but the well defined variation of sample parameters by the irradiation induced defects as a continuous sample preparation procedure of the same sample. Because of the high Rutherford dislocation cross section, fast heavy ions are the best tool to achieve this within a short irradiation time.

15043 **Transitions of superconductors into ferro- and antiferro- magnets.** Varma, C.M. (Bell Labs., Murray Hill, NJ). pp 391-402 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Recent discoveries of superconducting compounds that contain a lattice of rare-earth ions have reopened the questions of interaction of superconductivity and magnetic order that were a topic of considerable discussion in the 1960's. At that time it was not possible to come to clear conclusions because the materials investigated contained magnetic ions that were disordered in the lattice and possibly existed in a clustered form. The principal conclusions of the new experimental work, for the points of interest in this talk, are: (1) the ferromagnetic transition below the superconducting transition is of first-order and superconductivity disappears below this transition; (2) antiferromagnetism often co-exists with superconductivity. However there is evidence that the pairbreaking effects due to the magnetic ions are enhanced near and in the antiferromagnetic phase.

15044 **Low temperature thermal conductivity of $ErRh_4B_4$.** Ott, H.R.; Odoni, W. (Laboratorium fuer Festkoerperphysik, Zuerich, Switzerland). pp 403-408 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The thermal conductivity of polycrystalline $ErRh_4B_4$ was measured between 0.05 K and 4 K, and in magnetic fields up to 3 kOe with directions parallel and perpendicular to the heat flow. The transition from the superconducting to the magnetically ordered normal state is hysteretic in temperature as observed before in resistivity measurements.

15045 **Ion damage, critical current and tunneling studies of $ErRh_4B_4$ films.** Rowell, J.M.; Dynes, R.C.; Schmidt, P.H. (Bell Labs., Murray Hill, NJ). pp 409-418 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

It was recently speculated that the unusual sensitivity of the A15 superconductors to damage by neutrons, α particles or electrons will be a common behavior in all cluster compound superconductors. This was demonstrated, at least for $ErRh_4B_4$, by showing the rapid depression of the superconducting and magnetic transition temperatures (T/sub c/ and T/sub m/) with α particle damage, and that T/sub c/ depended on the resulting resistance ratio in a fashion exactly similar to that in the high T/sub c/ A15s. Some further details of these damage studies of $ErRh_4B_4$ films, and also some preliminary critical current and tunneling measurements are reported here.

15046 **Calculations of the superconducting and transport properties of A15 structure compounds.** Klein, B.M.; Papaconstantopoulos, D.A.; Boyer, L.L. (Naval Research Lab., Washington, DC). pp 455-471 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Electronic band structure calculations have been made for a series of 10 different A15 structure compounds V_3X and Nb_3X, X = Al, Ga, Si, Ge, and Sn having both high and low superconducting transition temperatures, T/sub c/. These results have been used to study the superconducting properties of these materials along with a discussion of the thermal anomalies present in some of them. This paper makes use of the aforesaid results, and also some new results for Nb_3Sb, to present calculations of Fermi velocities, plasma frequencies, mean free paths, and, resistivities for all of these materials. In addition arguments are advanced on how to use these results to predict even higher T/sub c/ materials as recently formulated by Papaconstantopoulos. Specifically, it is predicted that T/sub c/ $>$ 15K for the pseudobinary A15 alloy $(V_{1-x}Ti_x)_3Ge$, $x \sim 0.13$.

15047 **Eliashberg function and the superconducting T/sub c/ of transition metal hexaborides.** Schell, G.; Winter, H.; Rietschel, H. (Inst. fuer Angewandte Kernphysik, Karlsruhe, Germany). pp 465-471 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The superconducting properties of lanthanum hexaboride and ytterbium hexaboride are investigated on a microscopic level by calculating their Eliashberg functions $\alpha^2F(\omega)$. (GHT)

15048 **Superconducting hydrides of transition metal alloys.** Friedberg, C.B.; Rex, A.F.; Ruvalds, J. (Univ. of Virginia, Charlottesville). pp 473-477 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

The superconducting properties of some transition metal hydrides are examined. Since the equilibrium solubility of hydrogen is generally quite small in these alloys, previous studies of such materials by conventional techniques have been restricted to Pd deficient samples. The ion implantation technique allows the fabrication of a wide variety of hydride materials, and the results are reported for PdNb/sub x/H/sub y/, PdTa/sub x/H/sub y/, PdBi/sub x/H/sub y/ and PdZn/sub x/H/sub y/ alloy systems. (GHT)

15049 **Low temperature normal-state electrical resistivity anomalies in some disordered d-band superconductors.** Hake, R.R.; Aryainejad, S.; Karkut, M.G. (Indiana Univ., Bloomington). pp 479-484 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Recent experimental and theoretical effort has been devoted to the study of the unusual temperature dependence of the normal-state electrical resistivity of A15 compound superconductors. The extension of high-H helium-temperature measurements to amorphous $Ti_{50}Be_{40}Zr_{10}$ and to bcc $V_{80}Al_{20}$ is reported. (GHT)

15050 **New ternary molybdenum chalcogenides.** Fischer, O.; (Univ. de Geneva, Switzerland); Seeber, B.; Decroux, M.; Chevrel, R.; Potel, M.; Sergent, M. pp 485-494 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Ternary molybdenum chalcogenides of the type $M_xMo_6X_8$ ($0 \leq x < 4$, M = metal, X = S, Se, Te) are known for a series of unusual superconducting and normal state properties, like coexistence of antiferromagnetic and superconductivity and extremely high critical fields. The reason why these and other ternary compounds like the $(RE)Rh_4B_4$ compounds show such anomalous behavior is clearly correlated with the increased liberty that nature has in composing structures of ternary compounds as compared with binary ones. Thus it is perhaps not surprising that one finds qualitatively different properties in such materials as compared with binary compounds and alloys, in the same way as the latter materials show superconducting properties quite different from those of the pure elements. This paper illustrates the point made above by discussing different types of new ternary molybdenum chalcogenides.

15051 **Magnetic interactions in ternary superconductors.** Shenoy, G.K. (Argonne National Lab., IL); Dunlap, B.D.; Fradin, F.Y.; Sinha, S.K.; Kimball, C.W. pp 495-499 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

There has been a continued effort at Argonne to investigate the properties of ternary superconductors using microscopic tools such as NMR, Moessbauer spectroscopy and neutron scattering. The present review deals with the magnetic interactions as obtained from Moessbauer spectroscopy and compares them with results obtained from other tools.

15052 **Heat capacity and electrical resistivity of Chevrel phase superconductors.** Nerz, K.P.; Poppe, U.; Pobell, F.; Weger, M.; Wuehl, H. (Inst. fuer Festkoerperforschung, Juelich, Germany). pp 501-508 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Measurements of the specific heat of $Mo_{6.3}Se_8$ at 1.5 K $\leq$ T $\leq$ 20 K which show substantial deviations to former data are reported. Furthermore, results for the presence and temperature dependence of the electrical resistivity of single crystal $Pb_{0.8}Mo_{6.4}S_8$ at 12 K $\leq$ T $\leq$ 300 K and up to 14 kbar will be reported. There is a marked change in the pressure dependence of the residual resistivity and of the temperature dependent part of the resistivity at around 4 kbar.

15053 **Influence of the formal electric charge on the size of the transition metal atom cluster in YRh_4B_4, YRu_4B_4 and $PbMo_6S_8$ related compounds.** Yvon, K.; Gruettner, A. (Univ. of Geneva, Switzerland). pp 515-519 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

A single-crystal x-ray study of the superconducting compounds MRh_4B_4 (M = Y, Th), Y (Ru/sub 1-x/Rh/sub x/)$_4B_4$ and M Mo_6S_8 (M = Ag, Cu, Pb, Sn, In, Rare Earths) shows that the size of the T atom cluster (T = transition metal) changes as a function of its formal charge. An increase of the formal charge by one electron leads to an expansion of the T_4 tetrahedron by about 1% in the borides and to a contraction of the T_6 octahedron by about 2% in the chalcogenides. The relative displacements of the T atoms due to this electronic effect are of the same order of magnitude as their r.m.s. amplitudes of thermal vibrations at low temperatures.

15054 **Self-consistent electronic band structure of Chevrel phase compounds.** Jarlborg, T. (Northwestern Univ., Evanston, IL); Freeman, A.J. pp 521-525 of Superconductivity in d- and f-band metals. Suhl, H.; Maple, M.B. (eds.). New York, NY; Academic Press, Inc. (1980).

From Superconductivity in d- and f-band metals; San Diego, CA, USA (21 Jun 1979).

Results of the first ab initio self-consistent linear muffin-tin orbital energy band studies of several of the MMo_6X_8 compounds which include all electrons and all 15 atoms in the unit cell are reported. These results, mostly in the form of total and partial (by atom type and orbital angular momentum) density of states are used to interpret a number of experiments. (GHT)

6570 Theoretical Physics

15055 **(UCID—18713) Calculations of stimulated Brillouin scatter with LASNEX.** Estabrook, K.; Harte, J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jun 1980. Contract W-7405-ENG-48. 6p. NTIS, PC A02/MF A01.

A model was developed that predicts the fraction of light absorbed by gold disks over a wide range of intensities and factor of 2 in laser wavelength. A figure shows LASNEX predictions for absorption and Brillouin reflection for 1 ns laser light from 0.25 to 4.0 μm wavelength and intensities varying from 3 x 10^{13} to 3 x 10^{16}. 1 figure. (RWR)

15056 **Photon number statistics in resonance fluorescence.** Cook, R.J. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). W-7405-ENG-48. *Physical Review, The, A. General Physics ;* **23**: No. 3, 1243-1250(Mar 1981).

Exact closed-form expressions for the probability p(n) that n photons are spontaneously emitted in a given time by a two-level atom in a coherent exciting field are derived using the theory of atomic motion in a traveling wave.

15057 **Correlation functions and the onset of chaotic motion.** Koszykowski, M.L.; Noid, D.W.; Tabor, M.; Marcus, R.A. (Sandia National Laboratories, Livermore, California 94550). *Journal of Chemical Physics, The ;* **74**: No. 4, 2530-2535(15 Feb 1981).

A variety of correlation functions computed over a microcanonical ensemble for the Henon—Heiles system are investigated. We find the general trend is that of a gradual change to some form of decaying behavior as the motion becomes predominantly chaotic. The decay of a mode energy correlation function indicates a time scale for intramolecular energy redistribution.

15058 **Solvable models with self-triality in statistical mechanics and field theory.** Shankar, R. (Josiah Willard Gibbs Laboratory, Yale University, New Haven, Connecticut 06520). EY-76-0C-02-3075. *Physical Review Letters ;* **46**: No. 6, 379-382(9 Feb 1981).

The notion of self-duality is extended to self-triality. One example from spin systems is given and completely solved by use of fermion variables. It is then shown that the O(8) Gross-Neveu model has self-triality: The Lagrangian L(psi)=L(R)=L(L) where psi is the original fermion while R and L are two types of kinks that occur dynamically. The anatomy of self-duality (triality) in the Ising and present examples is exposed as is the origin of the fermionic solutions.

15059 **Aplanatic waxicons.** Minerbo, G.N. (Los Alamos Scientific Lab., NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 10-14(1979).

From LASL conference on optics '79; Los Alamos, NM, USA (23 May 1979).

Waxicon mirror components offer many advantages in designing optical systems for transporting high power laser beams. The widespread use of waxicons has been limited because of their high sensitivity to tilt errors. This paper gives the equations of the surfaces of a waxicon that is rigorously corrected for both spherical aberration and coma. Computer ray tracing has confirmed its low sensitivity to tilt errors: if the aplanatic waxicon as a whole is tilted by a small angle δ, the RMS wavefront error in the output beam will be proportional to δ^2.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 15006, 15007, 15118

15060 **(CONF-801247—(Summ.)) Summary of US-Japan workshop on the theory of non-axisymmetric confinement systems.** (Texas Univ., Austin (USA). Inst. for Fusion Studies). Jan 1981. Contract FG05-80ET53088. 22p. NTIS, PC A02/MF A01.

From US/Japan workshop on the theory of non-axisymmetric confinement systems; Austin, TX, USA (8 Dec 1980).

Summaries are given for the following sessions: (1) stellarators and heliotrons; (2) tandem mirrors; and (3) bumpy torus. (MOW)

15061 **(GA-A—16178) ONETWO: a computer code for modeling plasa transport in tokamaks.** Pfeiffer, W.W.; Davidson, R.H.; Miller, R.L.; Waltz, R.E. (General Atomic Co., San Diego, CA (USA)). Dec 1980. Contract AT03-76ET51011. 201p. NTIS, PC A10/MF A01.

ONETWO is a one-and-a-half-dimensional, time-dependent computer code for modeling plasma transport in tokamaks. Both circular and noncircular cross-section plasmas, including doublets, can be modeled along with currents in field-shaping coils. Electrons, several species of ions, and two species of neutrals may be considered simultaneously. The electrons and ions are treated as fluids, while the neutrals are treated kinetically. Neoclassical and several anomalous transport models are available. Important physical processes that produce sources and sinks of particles and energy are also considered, including ohmic heating, electron-ion energy exchange, radiation, neutral transport (and gas puffing), neutral beam heating, RF heating, pellet fueling, and fusion.

15062 **(ORNL/TM—7120) Tensor pressure tokamak equilibrium and stability.** Cooper, W.A. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 162p. NTIS, PC A08/MF A01.

We investigate the equilibrium and magnetohydrodynamic (MHD) stability of tokamaks with tensor pressure and examine, in particular, the effects of anisotropies induced by neutral beam injection. Perpendicular and parallel beam pressure components are evaluated by taking moments of a distribution function obtained from the solution of a Fokker-Planck equation that models the injection of high-energy neutral beams into a tokamak. We numerically generate D-shaped beam-induced tensor pressure equilibria. A double adiabatic energy principle is derived from a modified version of the guiding center plasma energy principle. Finally, we apply the tensor pressure ballooning mode equation to computed equilibria that model experimentally determined ISX-B discharge profiles with high-power neutral beam injection. We predict that the plasma is unstable to flutelike modes in the central core of the discharge as a result of the pressure profile peakedness induced by the beams.

15063 **(ORNL/TM—7486) Experimental investigation of solid hydrogen pellet ablation in high-temperature plasmas using holographic interferometry and other diagnostics.** Thomas, C.E. Jr. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 238p. NTIS, PC A11/MF A01.

The technology currently most favored for the refueling of fusion reactors is the high-velocity injection of solid hydrogen pellets. Design details are presented for a holographic interferometer/shadowgraph used to study the microscopic characteristics of a solid hydrogen pellet ablating in an ~ 1-keV plasma. Experimental data are presented for two sets of experiments in which the interferometer/shadowgraph was used to study ~ 1-mm-diam solid hydrogen pellets injected into the Impurity Study Experiment (ISX-B) tokamak at Oak Ridge National Laboratory (ORNL) at velocities of 1000 m/s. In addition to the use of the holographic interferometer, the pellet ablation process is diagnosed by studying the emission of Balmer-alpha photons and by using the available tokamak diagnostics (Thomson scattering, microwave/far-infrared interferometer, pyroelectric radiometer, hard x-ray detector).

15064 **(PPPL—1676) Fast-wave heating in the two-ion hybrid regime on PLT.** Hwang, D.Q.; Chrien, R.E.; Colestock, P. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1981. Contract AM02-76CH03073. 29p. NTIS, PC A03/MF A01.

Plasma heating using the fast magnetosonic wave in the ion cyclotron range of frequencies is being studied both experimentally and theoretically in order to evaluate its potential for heating reactor plasmas. RF pulses at power levels up to 800 kW and length >130 ms have been delivered to a set of two parallel 1/2 turn loop antennae with 80% of the power coupled to the plasma. The parallel antennae have been driven both in and out-of-place so that the k/sub phi/ dependence of the antenna coupling and plasma heating can be determined. The heating experiments were conducted in the two-ion hybrid regime where the deuterium plasma contained a small component of a second ion species (hydrogen or ^{3}He). A bulk ion temperature increase of up to 1.2 keV has been achieved at the 620 kW power level with ^{3}He as the minority species and anti n/sub e/ = 2.9 x 10^{13} cm^{-3}. Energetic minority distributions have been detected consistent with theory.

15065 **(PPPL—1742) Numerical simulations on electrostatic hydrogen cyclotron instabilities.** Okuda, H.; Cheng, C.Z.; Lee, W.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1981. Contract AM02-76CH03073. 38p. NTIS, PC A03/MF A01.

Both one- and two-dimensional particle simulation models have been used to study the nonlinear behavior of the electrostatic hydrogen cyclotron instabilities driven by the electron current along magnetic field. It is found that the instability saturates as a result of electron velocity space diffusion along magnetic field. The cyclotron waves remain highly coherent in the nonlinear stage. When the electron drift speed is comparable to thermal speed, substantial ion heating as well as particle cross-field diffusion comparable to Bohm diffusion has been observed. Comparisons of the simulation results with the theoretical predictions and the observations in both laboratory and space plasmas are discussed.

15066 **(PPPL—1746) Non-resonant parametric decay of lower-hybrid waves in the ACT-1 toroidal device.** Wong, K.L.; Ono, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1981. Contract AM02-76CH03073. 17p. NTIS, PC A02/MF A01.

Non-resonant parametric decay of lower-hybrid waves, observed in a number of high-power tokamak rf heating experiments, is positively identified as a decay into ion-cyclotron quasi-modes. The decay-wave spectrum, wavelength and amplitude profile are measured inside a toroidal plasma with pump frequency f_0 ~ 3.5 f/sub π/ ~ 25 f/sub ci/.

15067 **(PPPL—1752) Effect of noise on the standard mapping.** Karney, C.F.F.; Rechester, A.B.; White, R.B. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Mar 1981. Contract AM02-76CH03073. 26p. NTIS, PC A03/MF A01.

The effect of a small amount of noise on the standard mapping is considered. Whenever the standard mapping possesses accelerator models (where the action increases approximately linearly with time), the diffusion coefficient contains a term proportional to the reciprocal of the variance of the noise term. At large values of the stochasticity parameter, the accelerator modes exhibit a universal behavior. As a result the dependence of the diffusion coefficient on stochasticity parameter also shows some universal behavior.

15068 **(PPPL—1761) Electrostatic drift wave eigenmodes in tokamaks.** Cheng, C.Z.; Tsang, K.T. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Oak Ridge National Lab., TN (USA)). Mar 1981. Contract AM02-76CH03073. 28p. NTIS, PC A03/MF A01.

The eigenmode equation governing both the toroidicity-induced and the ion temperature gradient driven modes of arbitrary wavelengths in tokamaks is derived by employing the ballooning mode formalism. For the toroidicity-induced mode (electron driftwave), the ion magnetic drift resonances are destabilizing and can have a significant effect when the temperature ratio, T/sub e// T/sub i/, is of order unity. The ion temperature gradient driven mode (ion drift wave), which is unstable in a shear slab geometry, is found to be further destabilized by the ion magnetic drifts, resulting in a lower critical ion temperature gradient (eta/sub i/).

15069 **(PPPL—1762) Plasma equilibrium with rational magnetic surfaces.** Boozer, A.H. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1981. Contract AM02-76CH03073. 19p. NTIS, PC A02/MF A01.

The self consistent classical plasma equilibrium with diffusion is studied in a toroidal geometry having a sheared magnetic field. Near each rational surface it is found that the pressure gradient is zero unless the Fourier component of $1/B^2$, which resonates with that surface, vanishes. Despite the resonances, the overall plasma confinement is, in practice, only slightly modified by the rational surfaces.

15070 **(PPPL—1765) Atomic phenomena in dense plasmas.** Weisheit, J.C. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Mar 1981. Contract AM02-76CH03073. 86p. NTIS, PC A05/MF A01.

The following chapters are included: (1) the plasma environment, (2) perturbations of atomic structure, (3) perturbations of atomic collisions, (4) formation of spectral lines, and (5) dielectronic recombination. (MOW)

15071 **(SAND—80-0968) Parameterization of x-ray production in laser-produced plasmas.** Peek, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1980. Contract AC04-76DP00789. 43p. NTIS, PC A03/MF A01.

A simple and algebraically tractable model is developed for the efficiency of x-ray production in a certain spectral region by laser driven plasmas. The model is used as a interpolation/extrapolation device for experimental and theoretical results from three different target concepts. These tests indicate that it is of use in its intended capacity. Certain relationships between independent parameters and scaling laws also result from this construction. Most notable among these is the prediction that the efficiency for producing line radiation in a certain narrow energy range scales like the inverse square of this energy.

15072 **(SAND—80-2726) Recommendations for applying flash x-radiographic (FXR) techniques to the study of low-density material ejected from shocked Pb surfaces.** Karioris, F.G.; Fehl, D.L. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1980. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01.

Radiographs of thin Pb absorbers (area density range 0.003 to 0.6 g/cm^2) were made with a pulsed 3 ns duration x-ray source and x-ray film backed with radiographic screens. Although the

source-to-film distance was fixed at 100 cm, the object-to-film distance x-ray photon energy, and film/screen combination were varied individually. Recommendations based on this data are made for a proposed flash x-radiography experiment with shocked Pb targets on the two-stage light gas gun facility at Sandia National Laboratories.

15073 **(UCID—18883) Impurity study of TMX using ultraviolet spectroscopy.** Allen, S.L.; Strand, O.T.; Moos, H.W.; Fortner, R.J.; Nash, T.J.; Dietrich, D.D. (California Univ., Livermore (USA). Lawrence Livermore Lab.; Johns Hopkins Univ., Baltimore, MD (USA)). 31 Jan 1981. Contract W-7405-ENG-48. 57p. NTIS, PC A04/MF A01.

An extreme ultraviolet (EUV) study of the emissions from intrinsic and injected impurities in TMX is presented. Two survey spectrographs were used to determine that the major impurities present were oxygen, nitrogen, carbon, and titanium. Three absolutely-calibrated monochromators were used to measure the time histories and radial profiles of these impurity emissions in the central cell and each plug. Two of these instruments were capable of obtaining radial profiles as a function of time in a single shot.

15074 **(UCID—18940) Sausage mode of a pinched charged particle beam.** Lee, E.P. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 10 Feb 1981. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01.

The axisymmetric oscillations of a self-pinched charged particle beam are analyzed using a dispersion relation derived from a 3/2 dimensional model. This calculation includes the effects of rounded profiles, finite conductivity, a steady return current, and phase mix damping among particle orbits. However, only the lowest order radial mode of distortion is treated, and this is done in an approximate fashion.

15075 **(UCID—18980) Existence of a last invariant of conservative motion.** Hall, L.S. (Lawrence Livermore National Lab., CA (USA)). 6 Mar 1981. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01.

15076 **(UCRL—53051) MFTF Thomson scattering: a system study.** Frank, A.M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Sep 1980. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01.

This report documents the design effort for a Thomson scattering diagnostic system for MFTF. The principal problem is obtaining enough photons, in the presence of a poorly known background, to make satisfactory measurements. No currently available laser will yield enough photons to do this. Design concepts for imaging and detection are discussed. The ability of components to survive in the high-radiation environment of MFTF is identified as an important problem. The transition to MFTF-B makes many of the problems identified here more serious.

15077 **(UCRL—85255) Effects of anomalous transport on lower hybrid electron heating.** McCoy, M.G.; Harvey, R.W. (California Univ., Livermore (USA). Lawrence Livermore National Lab.; General Atomic Co., San Diego, CA (USA)). Feb 1981. Contract W-7405-ENG-48. 5p. (CONF-810214—3). NTIS, PC A02/MF A01.

From 4. topical conference on radio frequency plasma heating; Austin, TX, USA (9 Feb 1981).

The transport of electron energy out of tokamaks is known to be far greater than that calculated using classical and neoclassical theory. However, low levels of non-axisymmetric magnetic field turbulence can couple the fast transport of electrons parallel to the magnetic field lines to radial transport, thus providing a plausible explanation for observed energy confinement. These models further predict that the electron loss rate is proportional to v/sub parallel bars/. This has subsequently been found to be consistent with data for runaway electrons in PLT, at energies up to 1 MeV. Recently it has been pointed out by Chan, Chiu and Ohkawa that anomalous transport processes should be taken into account in attempting to determine steady state electron distribution functions for cases involving RF electron tail heating, particularly in view of the v/sub parallel bars/ dependence of the loss rate. In this work these physical processes are modeled through a 2-D nonlinear program which describes the evolution of the electron distribution function in velocity magnitude; (v) and plasma radius (r), and which studies the efficiency of tail electron heating.

15078 **Accessibility and energy deposition of lower hybrid waves in a tokamak with density fluctuations.** Bonoli, P.T.; Ott, E. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). *Physical Review Letters ;* **46**: No. 6, 424-427(9 Feb 1981).

A wave kinetic equation, including electromagnetic effects, to study the effects of scattering by density fluctuations on the accessibility of lower hybrid waves is derived. A Monte Carlo solution of the wave kinetic equation shows that the scattering, combined with toroidal effects and magnetic shear, can cause large upshifts in k/sub parallel/, thus allowing inaccessible waves to penetrate to the plasma center and heat. The implications of these results for past and future lower-hybrid—heating experiments are discussed.

15079 **Anomalous diffusion and ion heating in the presence of electrostatic hydrogen cyclotron instabilities.** Okuda, H.; Cheng, C.Z.; Lee, W.W. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). DE-AC0Z-76-CH03073. *Physical Review Letters ;* **46**: No. 6, 427-430(9 Feb 1981).

One- and two-dimensional particle simulations have been carried out to study electrostatic ion cyclotron instabilities for a hydrogen plasma in a strong magnetic field. It is found that strong ion heating and anomalous cross-field diffusion comparable to Bohm diffusion take place associated with the instability. Implications of the instability to the recent observations in fusion devices and space plasmas are discussed.

15080 **Electron heating and confinement measurements in the EBT-S toroidal core plasma with Thomson scattering.** Bighel, L.; Cobble, J.A. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). W-7405-ENG-26. *Physical Review Letters ;* **46**: No. 6, 430-433(9 Feb 1981).

A ruby-laser Thomson-scattering system, designed for very low—electron-density applications, has shown electron temperature (T/sub e/) and density (n/sub e/) profiles in the Elmo Bumpy Torus—Scale toroidal plasma to be flat, with T/sub e/ values from 50 to 500 eV and n/sub e/ values from 0.5 to 2.2 x 10^{12} cm^{-3}. Scaling of T/sub e/ and n/sub e/ with microwave power and background pressure is discussed. Electron-energy confinement times are derived and are found to scale approximately linearly with power for times up to 4 ms.

15081 **Measurement of HgXe (^{3}0$^+$) fluorescence efficiency in an electron-beam-preionized, volume-stable discharge and comparison with Boltzmann kinetics code calculations.** Hays, A.K.; Padrick, T.D. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789. *Journal of Applied Physics ;* **52**: No. 1, 13-18(Jan 1981).

A HgXe(^{3}0$^+$) fluorescence efficiency of 12 +- 2% was measured in an electron-beam-preionized, volume-stable discharge with an E/N value of 2 x 10^{-17} V cm^2. This efficiency was obtained for gas mixtures with mercury pressures in the range of 2—10 Torr and a constant xenon pressure of 3000 Torr. This efficiency was compared with Boltzmann-kinetics code calculations. It was found that processes involving molecular mercury formation had to be included in the kinetics code in order to obtain agreement between the measured and calculated HgXe (^{3}0$^+$) fluorescence efficiency.

15082 **Anode plasma behavior in a magnetically insulated ion diode.** Johnson, D.J.; Burns, E.J.T.; Quintenz, J.P.; Bieg, K.W.; Farnsworth, A.V. Jr.; Mix, L.P.; Palmer, M.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). DE-AC04-76-DP00789. *Journal of Applied Physics ;* **52**: No. 1, 168-174(Jan 1981).

The nature and time evolution of the "surface flashover" anode plasma in a magnetically insulated ion diode is studied. Holographic interferometric and spectrographic measurements indicate a plasma with an electron density of 5 x 10^{16} cm^{-3} and a temperature

of approximately 5 eV which is created by electric breakdown along a surface parallel to the imposed pulsed electric field. The divergence of the ion beam accelerated from this plasma is governed by the spatial nonuniformities of the plasma. The beam is composed primarily of protons for the experiments studied. Contrary to previous expectations, a substantial C^{+4} beam component was not observed.

15083 **Production of field-reversed plasma with a magnetized coaxial plasma gun.** Turner, W.C.; Granneman, E.H.A.; Hartman, C.W.; Prono, D.S.; Taska, J.; Smith, A.C. Jr. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). WQ-7405-ENG-48. *Journal of Applied Physics ;* **52**: No. 1, 175-182(Jan 1981).

Experimental data are presented on the production of field-reversed deuterium plasma by a modified coaxial plasma gun. The coaxial gun is constructed with solenoid coils along the inner and outer electrodes that, together with an external guide field solenoid, form a magnetic cusp at the gun muzzle. The net flux inside the inner electrode is arranged to be opposite the external guide field and is the source of field-reversed flux trapped by the plasma. The electrode length is 145 cm, the diameter of the inner (outer) electrode is 15 cm (32 cm). The gun discharge is driven with a 232-μF 40-kV capacitor bank. Acceleration of plasma through the magnetic cusp at the gun muzzle results in entrainment of field-reversed flux that is detected by magnetic probes 75 cm from the gun muzzle. Field-reversed plasma has been produced for a variety of experimental conditions. In one typical case, the guide magnetic field was B_0=4.8 kG and the change in axial magnetic field $\Delta B/\text{sub } z/$ normalized to B_0 was $\Delta B/\text{sub } z/ /B_0$=-3.1. Total field-reversed flux (poloidal flux) obtained by integrating $\Delta B/\text{sub } z/$ profiles is in the range 2 x 10^3 kG cm^2. Measurement of the orthogonal field component indicates a sizable toroidal field peaked off axis at r≈10 cm with a magnitude of roughly one-half the poloidal field component that is measured on magnetic axis. Reconnection of the poloidal field lines has not been established for the data reported in the paper and will be addressed in future experiments which attempt to trap and confine the field-reversed plasma in a magnetic mirror.

15084 **Numerical simulation of field-reversed θ-pinches.** Pietrzyk, Z.A. (Department of Nuclear Engineering, University of Washington, Seattle, Washington 98195). *Journal of Applied Physics ;* **52**: No. 1, 183-186(Jan 1981).

Field-line reconnection and the behavior of closed field-line plasma have been studied using a two-dimensional Lagrangian code. The effects of field-line divergence of the pinch end, active and passive mirrors, and laser heating are considered. A physical interpretation of plasma behavior for different experimental techniques is given. These calculations aid in understanding some of the experimental results of Los Alamos and the Kurchatov Institute.

15085 **Axial shock heating applied to compact toroid plasma formation.** Steinhauer, L.C.; Willenberg, H.J.; Hoffman, A.L. (Mathematical Sciences Northwest, Inc., Bellevue, WA). *Transactions of the American Nuclear Society ;* **34**: 23-24(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15086 **Heating by collisional slowing of fast ions in noncircular tokamaks.** Hively, L.M. (Univ. of Illinois, Urbana); Rome, J.; Miley, G.H. *Transactions of the American Nuclear Society ;* **34**: 24(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15087 **Secondary neutron streaming in plasma vacuum cavities surrounded by hybrid blankets.** Engdahl, J.C.; Whitley R.H. (TRW, Inc., Redondo Beach, CA). *Transactions of the American Nuclear Society ;* **34**: 42-43(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15088 **Plasma physics aspects of ETF/INTOR.** Peng, Y.K.M. (Oak Ridge National Lab., TN); Rutherford, P.H.; Schmidt, J.A.; Cohn, D.R.; Miller, R.L. *Transactions of the American Nuclear Society ;* **34**: 47-48(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15089 **Cyclotron radiation by a multi-group method.** Chu, T.C. Urbana, IL; Univ. of Illinois (1980). 84p. University Microfilms Order No. 80-26,467.

Thesis (Ph. D.).

A multi-energy group technique is developed to study conditions under which cyclotron radiation emission can shift a Maxwellian electron distribution into a non-Maxwellian; and if the electron distribution is non-Maxwellian, to study the rate of cyclotron radiation emission as compared to that emitted by a Maxwellian having the same mean electron density and energy. The assumptions in this study are: the electrons should be in an isotropic medium and the magnetic field should be uniform. The multi-group technique is coupled into a multi-group Fokker-Planck computer code to study electron behavior under the influence of cyclotron radiation emission in a self-consistent fashion. It was found that under normal thermonuclear conditions cyclotron radiation would not cause a significant shift in the electron distribution away from the normal Maxwellian. This is because of the strong influence of electron-electron collisions which forces a relaxation towards the Maxwellian. Several non-Maxwellian distributions were simulated to compare their cyclotron emissions with the corresponding energy and number density equivalent Maxwellian distributions. The results confirm that compared to a Maxwellian, an excess of slow electrons would radiate less while an excess of fast electrons would radiate more severely.

15090 **Laser spectroscopy of low pressure dc hollow cathode discharge plasmas.** Gerstenberger, D.C. Fort Collins, CO; Colorado State Univ. (1980). 102p. University Microfilms Order No. 80-28,736.

Thesis (Ph. D.).

A tunable single-frequency cw dye laser has been used as a plasma diagnostic tool for low pressure dc hollow cathode discharge plasmas. The narrow spectral character (<1 MHz) and continuous tunability of this device greatly simplify the analysis of spectroscopic data. Doppler-limited and Doppler-free spectroscopic data facilitated the measurement of atomic temperatures, the populations of various excited atomic states, and the density of electrons in the hollow cathode discharge. Rare gas and metal atoms were found to be in thermal equilibrium in a Ne-Cu discharge. The variation of temperatures of rare gas atoms with current was consistent with the observed V-I characteristics. The populations of various atomic states were described by simple models including the important collisional and radiative processes. Electron density measurements indicated that the discharge was diffusion-dominated under the conditions studied. The experimental results were used to estimate the expected performance of a He-Cu^+ laser.

15091 **Optical diagnostic system for observation of laser-produced shock waves.** Wilke, M.D.; Stone, S.N. (Los Alamos Scientific Lab., NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 380-387(1979).

From LASL optics conference '79; Los Alamos, NM, USA (23 May 1979).

Several standard plasma and gas dynamic diagnostic techniques have been integrated into a system for observing the formation and propagation of high-power Nd:glass-laser generated one- and two-dmensional shockwaves in air from 0.1 torr to atmospheric pressures. Diagnostics include either single-frame, two-wavelength holographic ruby-laser interferometry or single-frame, single-wavelength interferometry with ten frames of shadowgraphy. Streaks or ten frames of the early luminous shocked region also are taken on all shots, as well as time-resolved luminosity measurements using high-speed biplanar vacuum photodiodes with various wavelength interference filters. Shadowgraphy frames are 200-ns long at 1-μs intervals, while emission frames are variable with a maximum 10-ns exposure and 50-ns interval. Both the streak mode and emission

measurements with the vacuum diode allow subnanosecond time resolution. The interferometry provides 20 ns exposures from 500 ns to late times.

15092 **Observations and interpretations of magnetic-field-line reconnection and tearing in a theta pinch.** Irby, J.H. Baltimore, MD; Univ. of Maryland (1979). 112p. University Microfilms Order No. 80-01,655.

Thesis (Ph. D.).

Measurements and calculations are presented of reconnection and tearing of magnetic fields in the Maryland Fast Theta Pinch operated with initial bias and driving fields in opposite directions. Open magnetic field lines reconnect and form magnetic islands on time scales of the order of an Alfven transit time across the plasma sheath. Data in support of these conclusions consist primarily of extensive magnetic probe data used to map out the field lines, supplemented by spectroscopic temperature measurements, CO_2 laser interferometry, and spatially resolved light measurements. Implications of these results for plasma confinement are discussed.

15093 **Annihilation model of the Tormac sheath.** Hammer, J.H. Berkeley, CA; Univ. of California (1979). 144p. University Microfilms Order No. 80-00,366.

Thesis (Ph. D.).

A one-dimensional, steady state fluid model is developed to describe the boundary layer between plasma and magnetic field that occurs in the Tormac sheath. Similar systems which may be treatable by the same model are Tokamaks with divertors and reversed field mirrors.

15094 **Variational method for electromagnetic waves in a magneto-plasma.** Dominguez, R.R. Jr. Berkeley, CA; Univ. of California (1979). 129p. University Microfilms Order No. 80-00,326.

Thesis (Ph. D.).

A variational method is presented to derive the electromagnetic response for waves, of an arbitrary β model plasma, in a magnetic field whose curvature is simulated by an external gravitational field. The variational method, applied in the present work to slab and cylindrical plasma models, obtains the Maxwell integral equations in Fourier space in an algebraically simpler manner than previous methods and is particularly useful in deriving approximate Maxwell differential equations for long wavelength modes. The limitations of the frequently employed local approximation are established from the approximate differential equations and a symmetric set of local Maxwell equations are obtained which, neglecting Landau resonances, are manifestly Hermitian for real eigenfrequencies.

7002 Fusion Power Plant Technology

15095 **(DOE/ET/52025—9) Use of field ripple for burn phase control in short-pulse tokamak reactors.** Davidson, J.N.; Stacey, W.M. Jr. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering). May 1979. Contract AS05-78ET52025. 21p. NTIS, PC A02/MF A01.

The possible use of toroidal field ripple to control temperature excursions was investigated. In particular, the magnitude of the power savings necessary to control the ion temperature for about 120 seconds during the burn phase of an ETF tokamak was determined through the use of a global dynamics code. Then the amount of field ripple necessary to effect that control was calculated for each case. In the next section the basic properties of the simulation code are given and the various plasma cases investigated are described in some detail. There follows a discussion of the field ripple control mechanisms and their application to the problem at hand. Finally, the results of the study are presented along with the conclusions drawn from them.

15096 **(DOE/ET/52025—16) DIVERT: a divertor magnetic field line following code.** Morris, R.N.; Bateman, G. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering). May 1980. Contract AS05-78ET52025. 21p. NTIS, PC A02/MF A01.

The computer code DIVERT has been written to trace magnetic field lines in the presence of a divertor. Its purpose is to allow a user to estimate the thickness of the plasma scrapeoff region and to provide a visual mapping of the magnetic field lines near the divertor. Included in the code is the capability to provide auxiliary graphics and compute the field ripple. The code can handle a divertor made up of any arrangement of straight line coil segments and will provide a graph of the field line configuration on output.

15097 **(DOE/ET/52049—17) Summary: USA contribution to Session III, Phase 1 INTOR workshop.** Stacey, W.M. Jr.; Flanagan, C.A.; Kulcinski, G.L.; Schmidt, J.A.; Shannon, T.E. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering). Jun 1980. Contract AS05-79ET52049. 18p. NTIS, PC A02/MF A01.

The basic INTOR characteristics that were arrived at by the Phase-0 INTOR Workshop are summarized. These characteristics provided a point of reference for the analysis of major design issues. No requirement to change any of the suggested parameters was identified as a result of this analysis. The major design issues that were analyzed are listed. The results of these analyses and conclusions drawn therefrom are summarized.

15098 **(DOE/ET/52049—19) INTOR workshop.** Stacey, W.M. Jr. (Georgia Inst. of Tech., Atlanta (USA)). Oct 1980. Contract AS05-79ET52049. 23p. NTIS, PC A02/MF A01.

An intensive, international effort to define objectives and characteristics of the next major tokamak experiment and to assess its technical feasibility was completed in 1979. A preconceptual design is presently in progress.

15099 **(DOE/TIC—10122) Materials handbook for fusion energy systems.** (Hanford Engineering Development Lab., Richland, WA (USA)). 30 Apr 1980. Contract AC14-76FF02170. 43p. NTIS, PC A03/MF A01.

The purpose of the Materials Handbook for Fusion Energy Systems (MHFES) is to provide a readily available source of data to those involved in the design and analysis of fusion reactors or their components. Initially the focus of this Handbook will be on materials properties necessary for the design and analysis of the first wall and blanket structure of both near and long term fusion reactor concepts. However, as more data become available, this effort will be expanded to other aspects of fusion energy systems such as magnets and plasma heaters (neutral beam or R.F.).

15100 **(EPRI-AP—1702) Ceramic materials for fusion reactors.** Hopkins, G.; Trantina, G.C.; Corelli, J. (General Atomic Co., San Diego, CA (USA); General Electric Co., Schenectady, NY (USA); Rensselaer Polytechnic Inst., Troy, NY (USA)). Feb 1981. 165p. NTIS, PC A08/MF A01.

Materials studies have identified siliconized silicon carbide as the most promising material. It has a long-term service limit of 1200°C and can be fabricated in large shapes. Its strength and Weibull modulus do not decrease significantly at 1200°C after fast neutron irradiation up to a fluence of 1.2×10^{25} n/m^2. However, its thermal conductivity is reduced markedly during irradiation. Laboratory tests show that this affects the thermal shock resistance of silicon carbide adversely. How this will change the design of silicon carbide first walls remains to be evaluated.

15101 **(LBL—11602) Neutral beam development at LBL/LLNL.** Pyle, R.V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1980. Contract W-7405-ENG-48. 5p. (CONF-801011—81). NTIS, PC A02/MF A01.

From 4. ANS topical meeting on the technology of controlled nuclear fusion; King of Prussia, PA, USA (14 Oct 1980).

In a joint program LBL and LLNL are developing and testing neutral beam injection systems based on the acceleration of positive ions, for application in the 80- to 160-keV range on MFTF-B, D III, TFTR/TFM, ETF, MNS, etc. A conceptual design of a 160 keV injection system for the German ZEPHYR project is in progress. For applications at energies above about 200 keV, positive-ion-based system efficiencies are unacceptably low for most applications, and so negative-ion-based systems are being developed also.

15102 **(LBL—11825) Heavy ion fusion final focus system.** Krafft, G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Oct 1980. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01.

A system for transporting and focusing a 10 GeV U^{+4} beam in the high current regime is outlined. First descriptions of the beam model and the beam parameters used in the design are given. The goals and requirements are then briefly discussed, and an explanation of the design approach follows. A description of the system itself is next, followed by some discussion of its tolerances, both to momentum and current deviations. A brief summary of simulation results is then included. This note concludes with a short description of possible modifications and an evaluation of the design.

15103 **(LBL—12145) Ion accelerators as drivers for inertial confinement fusion.** Faltens, A.; Keefe, D.; Rosenblum, S.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1980. Contract W-7405-ENG-48. 6p. (CONF-801111—39). NTIS, PC A02/MF A01.

From 6. conference on application of accelerators in research and industry; Denton, TX, USA (Nov 1980).

During the past few years the possibility of using intense ion beams to ignite a pellet of fusion fuel has looked increasingly promising. Ion beams ranging in mass from protons up to uranium have been investigated and several machines have been built at different laboratories to investigate the required technology. Light ion drivers are based on the use of high current, high voltage diodes arranged around a central target. These devices have the necessary power and energy to initiate fusion burn but suffer from the inability to transport stably the necessary huge beam currents over long distances to a small target. Heavy ion drivers are based either on the radio-frequency linac or the induction linac. Because heavy ions have a much shorter range than light ions of the same energy, one is able to raise the beam voltage by a factor of one-thousand and lower the current correspondingly. The expected parameters for a fusion driver will be delineated and the present state of development of the technology for the candidate ion beam drivers will be described in light of these desiderata.

15104 **(LBL—12205) Particle simulation code for longitudinal dynamics of heavy ion beams.** Sternlieb, A.; Smith, L.; Laslett, L.J.; Bisognano, J.; Haber, I. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Naval Research Lab., Washington, DC (USA)). Jan 1981. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01.

A particle computer simulation code is presented, designed to describe the longitudinal motion of charged particles in a non-neutralized beam. The code is 1-d, electrostatic, and is capable of simulating coasting or bunched beams, cold or warm, with arbitrary wall impedance. External focusing forces are introduced in the bunched beam case. A variety of distribution functions can be represented. The code is self-consistent and it can follow both the linear and nonlinear evolution of a beam.

15105 **(ORNL/CSD/TM—136) ELMO Bumpy Torus data base.** Stanton, J.S. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 82p. NTIS, PC A05/MF A01.

This document describes a set of computer programs developed to facilitate storage and retrieval of data generated by the ELMO Bumpy Torus (EBT) experiment. The data is stored in a collection of files which contain either raw or analyzed data from diagnostics connected to the experiment. An on-line index of steady-state machine conditions, diagnostic or analysis status information, and raw or analyzed data values unifies the file collection into a data base. The index is implemented under the System 1022 data base management system.

15106 **(ORNL/TM—6566) Analytic solution of the inverse Solov'ev toroidal equilibrium.** Meier, H.K.; Sigmar, D.J. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 57p. NTIS, PC A04/MF A01.

An analytic, rapidly converging Fourier series is given for the poloidal flux surfaces psi(R,Z) = constant of the form R = Σ R/sub n/(psi)cos nθ, Z = Σ Z/sub n/(psi)sin nθ. Flux averaged quantities in closed analytic form are derived. This representation leads naturally to flux conserving equilibria. An accurate expression for the fraction of trapped particles valid at finite inverse aspect ratio and high beta has been derived and evaluated for the previously derived equilibria.

15107 **(PNL-SA—8253) Degassing rates of as-received and previously degassed graphite.** Gray, W.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 6p. (CONF-800607—93). NTIS, PC A02/MF A01.

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

Degassing rates have been measured on cylindrical samples 19 mm dia. x 25 mm long of a nuclear grade of graphite. A pressure-rise method was used together with a capacitance manometer vacuum gauge. Pressures were typically in the range 1 to 10^{-3} Pa (7.5×10^{-3} to 7.5×10^{-6} torr) except for degassing rates less than about 4×10^{-11} Pa.m³/s.g (3×10^{-10} torr.l/s.g) where the pressure never rose above 10^{-3} Pa.

15108 **(PNL-SA—9261) Fusion environment sensitive flow and fracture processes.** (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 51p. NTIS, PC A04/MF A01.

As a planning activity, the objectives of the workshop were to list, prioritize and milestone the activities necessary to understand, interpret and control the mechanical behavior of candidate fusion reactor alloys. Emphasis was placed on flow and fracture processes which are unique to the fusion environment since the national fusion materials program must evaluate these effects without assistance from other reactor programs.

15109 **(SAND—81-0074C) Chemical erosion of graphite.** Ashby, C.I.H. (Sandia National Labs., Albuquerque, NM (USA)). 1980. Contract AC04-76DP00789. 16p. (CONF-801246—2). NTIS, PC A02/MF A01.

From First-wall in INTOR workshop; Willow Brook, IL, USA (18 Dec 1980).

The interaction of graphite with hydrogen or oxygen will result in erosion of graphite surfaces under conditions similar to those found in tokamaks. Understanding the factors which influence these interactions and the magnitude of their respective contributions to the erosion of graphite is of vital importance in evaluating the utility of graphite in tokamak designs.

15110 **(UCAR—10060-80-2) Mirror Fusion. Quarterly report, April-June 1980.** O'Neal, E.M. (ed.). (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 29 Oct 1980. Contract W-7405-ENG-48. 73p. NTIS, PC A04/MF A01.

The information in each Quarterly is presented in the same sequence as in the Field Work Package Proposal and Authorization System (WPAS) submissions prepared for the US Department of Energy; the main sections are Applied Plasma Physics, Confinement Systems, Development and Technology, and Mirror Fusion Test Facility (Planning and Projects). Each of these sections is introduced by an overall statement of the goals and purposes of the groups reporting in it. As appropriate within each section, statements of the goals of individual programs and projects are followed by articles containing summaries of significant recent activity and descriptive test.

15111 **(UCID—18912) System data structures for on-line distributed data base management system.** Wade, J.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Jan 1981. Contract W-7405-ENG-48. 48p. NTIS, PC A03/MF A01.

Described herein are the data structures used in implementing a distributed data base management system (DBMS) for the Mirror Fusion Test Facility (MFTF), a part of the Mirror Fusion Energy Program at the Lawrence Livermore National Laboratory. The hardware and software frameworks within which the DBMS have been developed are first described, followed by a brief look at the motivation and fundamental design goals of the system. The structures are given in detail.

15112 **(UCRL—15314) Research on the HYLIFE liquid-first-wall concept for future laser-fusion reactors. Final report No. 5.** Hoffman, M.A. (California Univ., Davis (USA). Dept. of Mechanical Engineering). Sep 1980. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01.

It has been proposed to protect the structural walls of a future laser fusion reactor with a curtain or fluid-wall of liquid lithium jets. As part of the investigation of this concept, experiments have been performed on planar sheet water jets issuing vertically downward from slit nozzles. The nozzles were subjected to transverse forced harmonic excitation to simulate the vibrational environment of the laser fusion reactor, and experiments were run at both 1 atm and at lower ambient pressures. Linear temporal stability theory is shown to predict the onset of the unstable regime and the initial spatial growth rates quite well for the cases where the amplitudes of the nozzle vibration are not too large and the waveform is nearly sinusoidal. In addition, both the linear theory and a simplified trajectory theory are shown to predict the initial wave envelope amplitudes very well. For larger amplitude nozzle excitation, the waveform becomes highly nonlinear and non-sinusoidal and can resemble a sawtooth waveform in some cases; these latter experimental results can only be partially explained by existing theories at the present time.

15113 **(UCRL—83375) Microsphere rotator for automated interferometric target characterization.** Monjes, J.A.; Weinstein, B.W.; Willenborg, D.L.; Richmond, A.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 19 Jan 1981. Contract W-7405-ENG-48. 28p. (CONF-800208—27). NTIS, PC A03/MF A01.

From Topical meeting on inertial confinement fusion; San Diego, CA, USA (26 Feb 1980).

This report describes the mechanical and analytical design of a microsphere rotator (TOPO II) used in the automated interferometric surface characterization of laser fusion targets. The Target Characterization Group of Lawrence Livermore National Laboratory (LLNL) recently developed an automated measuring interferometer to rapidly and systematically characterize transparent laser fusion targets with regard to spherical surface figure and uniform wall thickness. A key element of this system is a mechanical microsphere rotator that allows the interferometer to systematically scan the entire surface of the target.

15114 **(UCRL—83522) Alternate laser fusion drivers.** Pleasance, L.D. (Lawrence Livermore National Lab., CA (USA)). Nov 1979. Contract W-7405-ENG-48. 40p. (CONF-791109—6). NTIS, PC A03/MF A01.

From 5. workshop on laser interaction; Rochester, NY, USA (5 Nov 1979).

One objective of research on inertial confinement fusion is the development of a power generating system based on this concept. Realization of this goal will depend on the availability of a suitable laser or other system to drive the power plant. The primary laser systems used for laser fusion research, Nd^{3+}: Glass and CO_2, have characteristics which may preclude their use for this application. Glass lasers are presently perceived to be incapable of sufficiently high average power operation and the CO_2 laser may be limited by and issues associated with target coupling. These general perceptions have encouraged a search for alternatives to the present systems. The search for new lasers has been directed generally towards shorter wavelengths; most of the new lasers discovered in the past few years have been in the visible and ultraviolet region of the spectrum. Virtually all of them have been advocated as the most promising candidate for a fusion driver at one time or another.

15115 **(UCRL—84992) Management of Shiva optics.** Marchi, F.T.; Wallerstein, E.P. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). Sep 1980. Contract W-7405-ENG-48. 16p. (CONF-800982—2). NTIS, PC A02/MF A01.

From Huntsville electro-optical technical symposium; Huntsville, AL, USA (29 Sep 1980).

In the design and procurement of a high power laser system such as the Shiva Fusion Laser at LLNL, the optical components are the single most important aspect for optimum laser performance. The cost, schedule and quality of the optics are the driving parameters for the entire program and many factors are involved in controlling, monitoring and evaluating these parameters. These factors include (1) the procurement cycle, (2) knowledge of the vendors, (3) realistic specifications, (4) understanding of the fabrication process, (5) the quality control and test requirements. Guidelines and examples of the methods used in the procurement and qualification of the optics in Shiva will be presented.

15116 **(UCRL—85524) Evaluation of bichromatic coatings designed for pulsed laser fusion applications at 0.53 and 1.06 micrometers.** Wirtenson, G.R.; Willis, J.B.; Enemark, E.A. (California Univ., Livermore (USA). Lawrence Livermore National Lab.; Optical Coating Lab., Inc., Santa Rosa, CA (USA)). Sep 1980. Contract W-7405-ENG-48. 14p. (CONF-8009119—2). NTIS, PC A02/MF A01.

From 12. annual symposium on optical materials for high power lasers; Boulder, CO, USA (Sep 1980).

Various bichromatic coatings designed to operate at both 0.53 and 1.06 micrometers have been evaluated for spectral performance and laser damage threshold to determine the suitability of these coatings for 1 nanosecond pulse laser fusion experiments and to establish baseline data. Anti-reflection, partially transmitting high reflection, and maximum reflection coatings, consisting of titania and silica layers, were deposited onto BK-7 substrates. For each type of coating, two different designs were examined. Spectral measurements indicate the coatings met performance goals. Laser damage threshold values at 1.06 micrometers were similar to those of previous monochromatic production coatings, while damage levels at 0.53 micrometers were about one-half these 1.06 micrometer values.

15117 **Evidence from x-ray, $3/2\omega$X, and $2\omega_0$ emission for laser filamentation in a plasma.** Herbst, M.J.; Stamper, J.A.; Whitlock, R.R.; Lehmberg, R.H.; Ripin, B.H. (Naval Research Laboratory, Washington, D.C. 20375). *Physical Review Letters ;* **46**: No. 5, 328-331(2 Feb 1981).

With long-pulse (4 nsec), moderate-intensity ($\approx 10^{13}$ W/cm^2) Nd-laser irradiation of flat targets, time-integrated images of $(3/2)\omega_0$ and $2\omega_0$ emission reveal filaments along the laser axis. Combined with fine-scale structure found in x-ray images, these filaments suggest self-focusing of hot spots in the incident beam.

15118 **Silicon satellite spectra from laser-imploded microballoons.** Lunney, J.G.; Seely, J.F. (Queen's University, Belfast, Northern Ireland). *Physical Review Letters ;* **46**: No. 5, 342-345(2 Feb 1981).

The dielectronic satellite spectral lines, on the long-wavelength side of the hydrogenic Si XIV Lyman-α line, have been observed in the space-resolved spectra from laser-imploded glass microballoons. In the electron density range 1×10^{22} to 2×10^{23} cm^{-3}, the intensities of the Si XIII $2s2p\ ^3P—1s2s\ ^3S$ and $2p^2\ ^3P—1s2p\ ^3P$ satellite lines increase with density in agreement with numerical modeling. These satellite lines are a promising density diagnostic for the imploded glass plasma.

15119 **Trace identification of cesium and sodium in neutral-beam research.** Ruby, L. (Univ. of California, Berkeley). *Transactions of the American Nuclear Society ;* **34**: 21-22(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15120 **Moving gas blanket feasibility study.** El-Derini, Z.; Abdou, M. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 22-23(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15121 **Impact of fusion-fission hybrids on world uranium demand.** Abdel-Khalik, S.I. (Univ. of Wisconsin, Madison); Jansen, P.; Kessler, G.; Klumpp, P. *Transactions of the American Nuclear Society ;* **34**: 25-26(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15122 **Flowing lithium/molten-salt fusion-fission hybrid design.** McGrath, R.T. (Univ. of Michigan, Ann Arbor); Berwald, D.H.; Maniscalco, J.A. *Transactions of the American Nuclear Society ;* **34**: 26-27(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15123 **Two-dimensional heating analysis by computer simulation of a fusion reactor synfuel blanket module in a neutron beam.** Lazareth, O.W.; Tsang, J.S.K.; Powell, J.R. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 27-29(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15124 **Design considerations for fusion synfuel blankets.** Wong, C.P.C.; Cheng, E.T.; Schultz, K.R.; Rovner, L.H. (General Atomic Co., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 29-30(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15125 **Potential of hybrid reactors with nuclear-pumped lasers.** Greenspan, E.; Miley, G.H. (Univ. of Illinois, Urbana). *Transactions of the American Nuclear Society ;* **34**: 30-31(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15126 **Error estimates of fissile fuel and tritium production in the SOLASE-H hybrid reactor.** Youssef, M.Z.; Maynard, C.W.; Conn, R.W. (Univ. of Wisconsin, Madison). *Transactions of the American Nuclear Society ;* **34**: 33-34(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15127 **Fusion Materials Irradiation Test facility initial target design.** Peterson, R.E.; Hassberger, J.A. (Hanford Engineering Development Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 35-36(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15128 **Accident-related dose rates due to different structural materials.** Bolon, A.E.; Jung, J.C. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 36-37(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15129 **Conceptual design of a linear spheromak fusion reactor.** Olson, R.E. (Univ. of Illinois, Urbana); Gilligan, J.G.; Miley, G.H.; Todd, A.M.M. *Transactions of the American Nuclear Society ;* **34**: 37-39(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15130 **Compact reverse-field pinch reactor.** Nebel, R.A. (Univ. of Illinois, Urbana); Moses, R.W.; Tetley, W.C.; Miley, G.H. *Transactions of the American Nuclear Society ;* **34**: 39-40(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15131 **Heavy-ion-beam fusion reactor conceptual design.** Pendergrass, J.H.; Frank, T.G.; Bohachevsky, I.O.; Booth, L.A. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 40-41(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15132 **Power requirements for lower hybrid-driven steady-state tokamaks.** Ehst, D.; Abdou, M. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 41-42(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15133 **Status of INTOR activity.** Stacey, W.M. Jr. (Georgia Inst. of Tech., Atlanta); Gilleland, J.R.; Kulcinski, G.L.; Rutherford, P.H. *Transactions of the American Nuclear Society ;* **34**: 44-45(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15134 **Engineering Test Facility: progress and plans.** Steiner, D. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 45(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15135 **R and D needs for the Engineering Test Facility.** Becraft, W.R. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 45-47(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15136 **Reflector-shield concept for fusion reactor designs.** Cheng, E.T. (General Atomic Corp., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 49-50(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15137 **Influence of blanket design options on tritium inventories in solid breeders.** Misra, B.; Clemmer, R.G.; Smith, D.L. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 50-51(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15138 **Impact of module size on the tritium breeding and energy conversion experiments in an ETF/INTOR reactor.** Gohar, Y.; Maroni, V.A. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 51-52(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15139 **Assessment of neutron multipliers for D-T solid breeder fusion reactors.** Gohar, Y. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 52-54(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15140 **Neutronic study of a lithium-lead-cooled tandem mirror reactor blanket.** Perry, R.T.; Maynard, C.W. (Univ. of Wisconsin, Madison). *Transactions of the American Nuclear Society ;* **34**: 54-55(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15141 **Reactions of Li-Pb alloys with water.** Finn, P.A.; Clemmer, R.G.; Armstrong, D.R.; Parker, N.E.; Bova, L. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 55-56(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15142 **Inertial confinement fusion reactor system integration.** Bohachevsky, I.O.; Frank, T.G. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 57-58(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15143 **Preliminary assessment of heavy ion fusion.** Booth, L.A.; Leonard, E.M. (Los Alamos Scientific Lab., NM). *Transactions of the American Nuclear Society ;* **34**: 58-59(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15144 **HYPERFUSE: a novel inertial confinement system utilizing hypervelocity projectiles for fusion energy production and fusion waste transmutation.** Makowitz, H.; Powell, J.R.; Wiswall, R. (Brookhaven National Lab., Upton, NY). *Transactions of the American Nuclear Society ;* **34**: 59-61(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15145 **Ion-beam wet-wood-burners using limited mass targets.** Greenspan, E.; Miley, G.H. (Univ. of Illinois, Urbana). *Transactions of the American Nuclear Society ;* **34**: 61-62(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15146 **Tritium self-sufficient pellet performance.** Miley, G.H.; Choi, C.; Powell, C.; Harris, D.; Blue, T. (Univ. of Illinois, Urbana). *Transactions of the American Nuclear Society ;* **34**: 62-63(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15147 **Opaque tamper shells for advanced fuel inertial confinement fusion.** Spulak, R.G. Jr.; Miley, G.H. (Univ. of Illinois, Urbana). *Transactions of the American Nuclear Society ;* **34**: 63-64(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15148 **Radiation shielding design considerations for Doublet III.** Engholm, B.A. (General Atomic Corp., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 640-642(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15149 **One-dimensional gamma-ray shielding calculations for the EBT-P.** Lillie, R.A.; Gabriel, T.A.; Bishop, B.L.; Baker, V.C. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 642-644(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15150 **Pulsed radiation damage in inertial confinement fusion stainless-steel first walls.** Ragheb, M.M. (Univ. of Illinois, Urbana); Kulcinski, G.L. *Transactions of the American Nuclear Society ;* **34**: 644-645(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15151 **Radioactive inventories and material recyclability in a tokamak power reactor.** Jung, J.; Abdou, M.A. (Argonne National Lab., IL). *Transactions of the American Nuclear Society ;* **34**: 645-647(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15152 **Scoping nucleonics study for fusion high-temperature blanket designs.** Cheng, E.T.; Wong, C.P.C.; Rovner, L.H. (General Atomic Corp., San Diego, CA). *Transactions of the American Nuclear Society ;* **34**: 647-648(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15153 **Irradiation creep by the climb-controlled glide mechanism in tokamaks.** Gurol, H. (Univ. of California, Santa Barbara); Ghoniem, N.M. *Transactions of the American Nuclear Society ;* **34**: 227-228(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15154 **Design of materials irradiation experiments utilizing spectral tailoring.** Gabriel, T.A.; Lillie, R.A.; Bishop, B.L. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 228-229(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15155 **Degassing rates of as-received and previously degassed graphite.** Gray, W.J. (Battelle Northwest Lab., Richland, WA). *Transactions of the American Nuclear Society ;* **34**: 240-242(1980). (CONF-800607—).
From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15156 **Fusion-product transport in axisymmetric tokamaks: losses and thermalization.** Hively, L.M. Urbana, IL; Univ. of Illinois (1980). 210p. University Microfilms Order No. 80-26,521.
Thesis (Ph. D.).
Fusion-product (fp) thermalization and heating are calculated assuming classical slowing down. The present analytical model describes fast ion orbits and their distribution function in realistic, high-β, non-circular tokamak equilibria. First-orbit losses, trapping effects, and slowing-down drifts are also treated. By solving a 3-D (+ time) PDE, it is possible to obtain an invariant of the slowing down process: μ/E = (magnetic moment)/energy = constant, and explicit expressions for the slowing-down drifts. Large banana-width effects give rise to a net co-going alpha particle current. The large banana-width orbits smear the energy deposition over large regions of the plasma. This causes the flux-surface-averaged ion heating rates to be 10 to 20% below in-situ rates on axis, but enhances the edge heating $\geq$ 10-fold over in-situ deposition. While this result implies reduced alpha ash accumulation on axis, the reduced heating rate makes start-up and maintenance of ignition more difficult.

15157 **Theoretical study on magnetic shielding of an ablating solid hydrogen pellet in a plasma and hydrogen pellet production and injection into the APEX tokamak.** Gilliard, R.P. Urbana, IL; Univ. of Illinois (1980). 114p. University Microfilms Order No. 80-26,499.
Thesis (Ph. D.).
The ablation rate of a solid hydrogen pellet in a plasma is the critical factor in determining the feasibility of pellet refueling of toroidal magnetically confined thermonuclear reactors. Initial experiments at Oak Ridge National Laboratory involving small pellets (diameter of order 200 μm) and plasmas below the thermonuclear range have produced data in good agreement with the predictions of scaling laws developed by Parks and Turnbull. These scaling laws are based on an ablation model which visualizes the ablating pellet to be surrounded by a neutral hydrogen ablation cloud in the plasma. Other authors have pointed out that in a thermonuclear plasma the ablation cloud may be highly ionized and may exclude

the magnetic field in the torus from the ablation cloud with a possible decrease in energy flux to the ablating pellet. The resulting so-called magnetic shielding ablation models predict pellet lifetimes significantly longer than the corresponding lifetimes of the neutral ablation cloud model. Most authors also correctly point out that the primary criterion for magnetic shielding to occur is a large magnetic Reynolds number. Unfortunately, the magnetic Reynolds number for an ablating pellet in proposed near-term magnetically confined thermonuclear devices is of order unity, leaving the validity of the different models open to question for actual reactors. In this work, the problem of magnetic diffusion into an ablation cloud and the corresponding effect on ablation rates is solved rigorously. Accurate criteria are developed for assessing the significance of magnetic shielding for various pellet and plasma configurations, and more generalized equations and scaling laws are presented which govern the ablation process in the case of partial shielding.

15158 **Ion bunching at high energies.** Johnson, G.B. Urbana, IL; Univ. of Illinois (1980). 89p. University Microfilms Order No. 80-26,531.

Thesis (Ph. D.).

Light ions offer several advantages over an electron beam or lasers as the driver for pellet fusion. This research deals with demonstrating that the electrostatic space charge fields produced by a reflex triode can be used to extract, accelerate, focus and bunch ions onto a target. The source of ions used in this experiment was preformed plasma produced by a hollow cathode discharge.

15159 **Interpretation of charged particle measurements on laser produced plasmas.** Nicholson, B.W. Rochester, NY; Univ. of Rochester (1980). 91p. University Microfilms Order No. 80-28,919.

Thesis (Ph. D.).

The ion current of an expanding laser produced plasma depends on both the ion charge state and the ion flux. It is shown that these are independent parameters of the plasma. The former is determined by recombination late in the plasma expansion. The latter reflects the target's dynamics early in time due to energy absorption and transport. Measurements show that the plasma's asymptotic charge state as a function of velocity is insensitive to changes in the incident energy. Numerical simulation confirms that the observed charge states are essentially independent of the target dynamics. The ion flux, on the other hand, is sensitive to variations in the modeling of both the energy absorption and transport. In particular the observed two peaked structure of the ion current depends on the amount of energy absorbed and the partitioning of that energy between thermal particles and non-thermal long range electrons. The shape of the valley between the two peaks depends on the flux limited thermal conductivity in the absorption region.

15160 **Fatigue behavior of type 316 stainless steel following neutron-irradiation-inducing helium.** Grossbeck, M.L.; Liu, K.C. (Oak Ridge National Lab., TN). *Transactions of the American Nuclear Society ;* **34**: 186-188(1980). (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

15161 **Damage resistance of CO_2 fusion laser optics.** Mewnam, B.E.; Gill, D.H. (Los Alamos Scientific Lab., NM). *Optical Engineering ;* **18**: No. 6, 579-585(Nov 1979).

We review the magnitudes of the damaged thresholds of practical optical materials, surfaces, and coatings found useful in short-pulse CO_2 fusion lasers and discuss the materials properties and laser parameters that affect the thresholds. The optics used in the eight-beam, 10-kilojoule, 20-terawatt, Helios system at Los Alamos are used as specific examples. Among the optcal components that caracterize the Helios system are NaCl windows up to 41 cm in diameter, diamond-turned copper mirrors of similar size, CdTe Pockels cell crystals, germanium saturable absorbers and polarizer plates and multilayer-coated ZnSe partial reflectors.

15162 **Mechanical stress compensation in multilayer dichroic mirrors for the 16 μm spectral region.** Baumeister, P. (Univ. of Rochester, NY); Pritts, J.; Lees, D.; Edwards, D.F. *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 89-90(1979).

From LASL conference on optics '79; Los Alamos, NM, USA (23 May 1979).

Multilayer quarterwave stacks were fabricated to reflect at $\lambda = 16$ μm. Due to the substantial metric thickness of the stack, the mechanical stress caused the coating to separate from the substrate. The optical thickness of the lead fluoride was 35% thicker than the zinc selenide in the stress-compensated design. The tensive stress of the former compensated the compressive stress of the latter.

15163 **Pyroelectric detectors for subnanosecond CO_2 laser pulse measurements.** Stotlar, S.C.; McLellan, E.J.; Webb, J.; Gibbs, A.J. (Los Alamos Scientific Lab., NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 347-354(1979).

From LASL conference on optics '79; Los Alamos, NM, USA (23 May 1979).

Sub-one-hundred-ps pyroelectric detectors are required for laser fusion and fast-time spectroscopy experiments. A Los Alamos Scientific Laboratory program is evaluating commercially available detectors and detector materials to develop a pyroelectric detector capable of fast operation without damage and compatible with the 5-GHz oscilloscope direct access mode of operation. The latter requires approximately 1-V signal levels across 50 Ω. The first phase of this program has been spent in developing a fast detector design. The fall time of the detector is approximately 30 ps, limited by a stray capacitance of 0.14 pf. The rise-time is less than 15 ps. Further improvements in the response time require reducing the stray capacitance. The second phase of this program is to measure the damage threshold of various pyroelectric materials and devices, evaluating several surface treatments and device preparation methods. Some of the materials under consideration include strontium barium niobate, lithium tantalate, lithium niobate and lanthanum-doped lead zirconate. Preliminary results will be presented.

15164 **New position-sensitive detector for pulsed or CW laser beam alignment.** Hammond, R.B. (Los Alamos Scientific Lab., NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 344-346(1979).

From LASL conference on optics '79; Los Alamos, NM, USA (23 May 1979).

A new class of position-sensitive detectors has been developed at Los Alamos Scientific Laboratory (LASL). These detectors utilize Seebeck effect and thermal diffusion in the detector material (Si). Large area (up to 125 cm^2) detectors with only four electrodes yield accurate x-y position sensing for CW and pulsed laser beams. The detectors are sensitive to any laser wavelength and feature high-optical damage thresholds ($>10^9$ W/cm^2 at 10 μm). The detector responses are found to agree accurately with a thermal diffusion model that has no adjustable parameters. These detectors are currently in use on Helios and are planned for use on Antares, the LASL laser fusion systems.

15165 **Application of phase conjugation to CO_2 fusion lasers.** Liberman, I. (Los Alamos Scientific Lab., NM). *SPIE (Society of Photo-Optical Instrumentation Engineers) Seminar Proceedings ;* **190**: 426-429(1979). (LA-UR—79-1651).

From LASL Conference on Optics 1979; Los Alamos, NM (USA) (23 May 1979).

The focal spot size and intensity of CO_2 laser beams which are used for fusion studies is degraded because of manufacturing defects in the optics train and because of alignment errors. Phase conjugation can in principle provide diffraction-limited performance despite imperfect optical components. This paper describes how such a system might be adapted to existing laser systems and discusses the problem areas which may be encountered.

99 GENERAL AND MISCELLANEOUS

15166 **(PB—80-812886) State-of-the-art reviews and bibliographies on energy. 1964-1978 (citations from the NTIS Data Base). Report for 1964-78.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 290p. NTIS PC N01/MF N01.

Citations to bibliographies, state-of-the-art reviews, and literature surveys on various aspects of fossil fuels, wind, solar

energy, hydrogen, geothermal energy, nuclear energy, and batteries are presented. A few citations pertain to electric power. (This updated bibliography contains 280 citations, none of which are new entries to the previous edition.)

15167 **(PB—80-812894) State-of-the-art reviews and bibliographies on energy. 1979-June, 1980 (citations from the NTIS Data Base). Report for 1979-jun 80.** Hundemann, A.S. (National Technical Information Service, Springfield, VA (USA)). Jul 1980. 117p. NTIS PC N01/MF N01.

Citations to bibliographies, state-of-the-art reviews, and literature surveys on various aspects of fossil fuels, wind, solar energy, hydrogen, geothermal energy, nuclear energy, and batteries are presented. A few citations pertain to electric power. (This updated bibliography contains 107 citations, 77 of which are new entries to the prevous edition.)

15168 **Transactions of the American Nuclear Society 1980 annual meeting.** Farmakes, R. (ed.). La Grange Park, IL; American Nuclear Society, Inc. (1980). 927p. (CONF-800607—).

From American Nuclear Society annual meeting; Las Vegas, NV, USA (8 Jun 1980).

Each of the brief summaries included was processed for the Energy Data Base. The summaries cover sessions on alternative energy technologies and systems; controlled nuclear fusion; education; environmental sciences; isotopes and radiation; materials science and technology; mathematics and computation; nuclear criticality safety; nuclear fuel cycle; nuclear reactor safety; power; radiation protection and shielding; reactor operations; reactor physics; remote systems technology; and thermal hydraulics.

9901 Management

REFER ALSO TO CITATION(S) 14171, 14172, 14173, 14174, 15178

15169 **(DOE—5700.4) Department of Energy Project Management System.** (Department of Energy, Washington, DC (USA)). 8 Jan 1981. 108p. TIC.

This manual provides guidance to all appropriate personnel for implementation of DOE Project Management Policy. It sets forth the principles and requirements that govern the development, approval, and execution of DOE's outlay programs as embodied within the Project Management System (PMS). Its primary goal is to assure application of sound management principles providing a disciplined, systematic, and coordinated approach resulting in efficient planning, organization, coordination, budgeting, management, review, and control of DOE projects. The provisions of this manual are mandatory for the Department's Major Systems Acquisitions (MSA's) and Major Projects and will be used for other projects to the extent practicable. Department's project-management task is over 250 projects, with a total estimated cost in excess of $24 billion at completion. This diverse array of project activities requires a broad spectrum of scientific, engineering, and management skills to assure that they meet planned technical and other objectives and are accomplished on schedule, within cost and scope, and that they serve the purposes intended. In recognition of these requirements and the Department's ever-increasing magnitude of responsibilities, an interim Project Management System was established and has been in use for over a year. This manual constitutes an update of the system based on the experience gained and lessons learned during this initial period.

9902 Mathematics And Computers

15170 **(ANL—81-6) Canonicalization and demodulation.** Veroff, R.L. (Argonne National Lab., IL (USA)). Feb 1981. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01.

Mechanisms that were developed for the Argonne National Laboratory - Northern Illinois University theorem proving system are discussed. By defining special input clauses and demodulators, it is possible to simulate mathematical processes such as canonicalization of polynomials with no special programming. The mechanisms presented resulted from a study of the $X^3 = X$ problem in ring theory. The use of the mechanisms allowed this problem to the solved for the first time by the automated theorem proving system.

15171 **(LA—8689-MS) Los Alamos Scientifc Laboratory computer benchmark performance 1979.** Hayes, A.H.; Bucher, I.Y. (Los Alamos Scientific Lab., NM (USA)). Feb 1981. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01.

Benchmarking of computers for performance evaluation and procurement purposes is an ongoing activity of the Research and Applications Group (Group C-3) at the Los Alamos Scientific Laboratory (LASL). Compile times, execution speeds, and comparison histograms are presented for a representative set of benchmark programs and the following computers: Cray Research, Inc. (CRI) Cray-1; Control Data Corporation (CDC) 7600, 6600, Cyber 73, Cyber 760, Cyber 750, Cyber 730, and Cyber 720; and IBM 370/195 and 3033. 54 figures, 4 tables.

15172 **(ORNL/CSD—76) Solving quadratic λ-matrix problems without factorization.** Scott, D.S.; Ward, R.C. (Oak Ridge National Lab., TN (USA)). Mar 1981. Contract W-7405-ENG-26. 26p. NTIS, PC A03/MF A01.

An algorithm is presented for computing the eigenvalues of smallest magnitude and their associated eigenvectors of the quadratic λ-matrix $M\lambda^2 + C\lambda + K$. M, C, and K are assumed to be symmetric matrices with K positive definite and M negative definite. The algorithm is based on a generalization of the Rayleigh quotient and the Lanczos method for computing eigenpairs of standard symmetric eigenproblems. Monotone quadratic convergence to the smallest positive and negative eigenvalue is proved. Test examples are presented.

15173 **(PNL-SA—7604) Microprocessor program development system.** Mathieu, T.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1979. Contract AC06-76RL01830. 7p. (CONF-790454—6). NTIS, PC A02/MF A01.

From DECUS spring mini/midi symposium; New Orleans, LA, USA (17 Apr 1979).

Microprocessors and microcomputers are rapidly becoming more and more prevalent today. But program development systems for microprocessor applications have not kept pace with the technological advancements. One solution to this problem has been accomplished by implementing the microprocessor development system in a high-level language and running it on a minicomputer. This approach enables the microprocessor development system to take advantage of the system facilities provided by the minicomputer. The implementation consists of a cross-assembler and linker written in Pascal for the INTEL 8086 microprocessor and runs on a DEC PDP-11/70. This paper describes microprocessor development systems and their capabilities in general, the INTEL 8086 and its development system in particular, and the benefits reaped from using a programming language such as Pascal for the implementation. (RWR)

15174 **(SAND—80-2684) Computer simulation program for parallel SITAN.** Andreas, R.D.; Sheives, T.C. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1980. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01.

This computer program simulates the operation of parallel SITAN using digitized terrain data. An actual trajectory is modeled including the effects of inertial navigation errors and radar altimeter measurements.

15175 **(UCID—18976) Combustion of reels of magnetic tapes.** Lipska, A.; Priante, S.; Beason, D.; Ford, H.; Stover, S. (Lawrence Livermore National Lab., CA (USA)). 6 Feb 1981. Contract W-7405-ENG-48. 22p. NTIS, PC A02/MF A01.

The flammability of magnetic tape assemblies used at the National Fusion Energy Computer Center was investigated. Experimental and large-scale tests showed that the magnetic computer tape, reels and cases decompose at fairly low temperatures; do not release detectable amounts of corrosive products at low heating rates; release small amounts of detectable corrosive products at high heating rates; form a wide variety of chemicals upon thermal degradation; ignite readily, produce copious amount of smoke, and are extremely hard to extinguish with water once the assemblies are fully involved. Reignition is probably due to the high heat capacity

of the metal oxide in the magnetic tapes. This finding suggests that a re-examination of the NFPA sprinkler standard for computer tapes storage facilities would be in order. 7 figures, 5 tables. (RWR)

15176 **(UCRL—84419) Computerized system for data handling.** Boyle, W.; Brand, H.; Yamauchi, R.; Bystroff, R. (Lawrence Livermore National Lab., CA (USA)). 1980. Contract W-7405-ENG-48. 16p. (CONF-801074—3). NTIS, PC A02/MF A01.

From 8. annual DOE compatibility meeting; Los Alamos, NM, USA (14 Oct 1980).

An open-ended, menu-directed set of FORTRAN programs is being written to produce graphic displays and otherwise process data from a number of different surface science instruments. To date, programs have been written for x-ray photoelectron (XPS, ESCA) and Auger spectroscopies. The data produced by these instruments are stored in a Nicolet, Model 1074, hard-wired, multichannel, data analyzer in 1024 channels. These 1024 data points are sent serially to the computer. The operator then enters the sample information and experimental parameters of the spectrum. The spectrum can then be manipulated using a variety of interactive graphic routines. The basic hardware for the system consists of an LSI-11/2, 10 Mbyte disk drive, and a 4027 Tektronix color graphics terminal. These programs have been designed with the aid of top-down structure diagrams. These diagrams are used to discuss the general feature of the programs and how they interact. Software, hardware, future expansion, and user reaction are also discussed. 10 figures.

15177 **Sharpness of Lorentz's theorem on incomplete polynomials.** Saff, E.B.; Varga, R.S. Contract EY-76-S-02-2075. *Transactions of the American Mathematical Society ;* **249**: No. 1, 163-186(Apr 1979).

For any fixed θ with $0 < \theta < 1$, G.G. Lorentz recently showed that bounded sequences [Σ/sub θ/n/sub i/ < = k < = n/ sub i/ α/sub k/(i)(1 + t)/sup k/] /sub i = 1//sup ∞/ of incomplete polynomials on [-1, +1] tend uniformly to zero on closed intervals of [-1, $\delta(\theta)$, where $2\theta^2 - 1 \leqq \Delta(\theta) < 2\theta - 1$. It is shown here that $\Delta(\theta) = 2\theta^2 - 1$ is best possible, and that the geometric convergence to zero of such sequences on closed intervals $[t_0,t_1]$ can be precisely bounded above as a function of t/sub j/ and θ. Extensions of these results to the complex plane are also included. 12 figures.

9903 Information Handling

REFER ALSO TO CITATION(S) 14140, 14691, 14730, 15169

15178 **(DOE/EIA—0205(80/4Q)) Energy Information Referral Directory. Fourth quarter 1980.** (Department of Energy, Washington, DC (USA). Energy Information Administration). 1980. 170p. NTIS, PC A08/MF A01.

This directory provides the name, address, and phone number of various energy information offices within the DOE and other Federal agencies. The arrangement is topical. Each entry presents the name of the office, the address, the main contact person, and a summary of the office's primary activities. There is a comprehensive subject index to the entries as well as a name index. In addition, the publication contains several appendices in which DOE Regional Energy Information Centers, state energy offices, DOE commercialization-resource managers, and DOE research and development and field facilities are listed. Charts illustrate the DOE and the EIA organizational structure.

15179 **(DOE/EIA—0229) National Energy Information System basic concepts.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Jul 1980. 26p. NTIS, PC A03/MF A01.

The basic concepts on which the National Energy Information System (NEIS) rests are described and clarified. Identified are the current state of, as well as future information gathering activities of the system. The NEIS was originally created under Congressional mandate to collect, process, and disseminate data useful for analysis of energy supply and consumption issues. An overview of NEIS, data descriptions, metadata (directories, documentation), and procedures of the NEIS system are discussed in a question-and-answer format.

CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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Source category survey: industrial incinerators. Final report, 6:14723 (PB—80-193303)
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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

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AC02-80EV10356	**Chicago Univ., IL (USA). Dept. of Biochemistry**	
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AC03-76ET28443	**San Diego Gas and Electric Co., CA (USA)**	
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AC03-79CS30307	**Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.**	
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AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
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AC05-76ER01067	**Triangle Universities Nuclear Lab., Durham, NC (USA)**	
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AC05-76OR00033	**Oak Ridge Associated Universities, Inc., TN (USA). Inst. for Energy Analysis**	
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AS02-76EV02270	**Wisconsin Univ., Madison (USA). Dept. of Zoology**	
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AS04-78ET35400	**California Univ., Los Angeles (USA). Dept. of Chemical, Nuclear, and Thermal Engineering**	
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AS22-78ET00234	**East Tennessee State Univ., Johnson City (USA). Dept. of Environmental Health**	
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CONF-800610-		(American Institute of Chemical Engineering conference, Philadelphia, PA, USA, 8-12 Jun 1980)
11	6:14201	*See* PNL-SA-8641
CONF-800627-		(Halden project conference, Halden, Norway, 1-6 Jun 1980)
2	6:13874	*See* PNL-SA-8576
3	6:13875	*See* PNL-SA-8638
CONF-800650-		(Symposium on oil and gas supply modeling, Washington, DC, USA, 18-20 Jun 1980)
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CONF-800684-		(International conference on experimentation at LEP, Uppsala, Sweden, 16-20 Jun 1980)
10	6:14601	*See* LBL-11957
11	6:14608	*See* ANL-HEP-CP-80-34

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CONF-8006143-	(Meeting on targets for neutron beam spallation sources, Juelich, F.R. Germany, 11-12 Jan 1980)	
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CONF-8006154-	(2. symposium on applied surface analysis, Dayton, OH, USA, 11-13 Jun 1980)	
1	6:14405	*See* PNL-SA-8588
CONF-800724-	(20. international conference on high energy physics, Madison, WI, USA, 17-23 Jul 1980)	
63	6:14954	*See* ANL-HEP-PR-80-49
64	6:14953	*See* ANL-HEP-PR-80-48
65	6:14955	*See* FERMILAB-Pub-80/54-THY
66	6:14942	*See* ANL-HEP-CP-80-33
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CONF-800782-	(SLAC/Summer Institute conference on the weak interaction, Menlo Park, CA, USA, 28 Jul-8 Aug 1980)	
2	6:14604	*See* SLAC-PUB-2647
CONF-800802-	(89. annual meeting of the American Institute of Chemical Engineers, Portland, OR, USA, 17-20 Aug 1980)	
24	6:13557	*See* COO-2981-61
25	6:13488	*See* PNL-SA-8755
CONF-800804-	(ASME century 2 emerging technology conference, San Francisco, CA, USA, 10-22 Aug 1980)	
37	6:13354	*See* PNL-SA-8245
CONF-800806-	(15. intersociety energy conversion engineering conference, Seattle, WA, USA, 18-22 Aug 1980)	
41	6:14220	*See* SERI/TP-641-849
CONF-800809-	(18. combustion symposium, Waterloo, Canada, 17-22 Aug 1980)	
7	6:14517	*See* SAND-80-8623
CONF-800892-	(Society for Industrial Microbiology annual meeting, Flagstaff, AZ, USA, 10-15 Aug 1980)	
1	6:13619	*See* SERI/TP-621-954
CONF-800895-	(International symposium on statistical mechanics of quarks and hadrons, Bielefeld, F.R. Germany, 24-27 Aug 1980)	
1	6:14959	*See* RLO-1388-840
CONF-800920-	(Geothermal Resource Council annual meeting, Salt Lake City, UT, USA, 9-11 Sep 1980)	
29	6:13792	*See* PNL-SA-8503
CONF-800944-	(7. symposium on microdosimetry, Oxford, UK, 8-12 Sep 1980)	
6	6:14997	*See* PNL-SA-8290
CONF-800979-	(Workshop on nuclear data evaluation methods and procedures, Upton, NY, USA, 22-25 Sep 1980)	
14	6:14990	*See* BNL-NCS-28933
CONF-800982-	(Huntsville electro-optical technical symposium, Huntsville, AL, USA, 29 Sep-2 Oct 1980)	
2	6:15115	*See* UCRL-84992
CONF-8009119-	(12. annual symposium on optical materials for high power lasers, Boulder, CO, USA, Sep 1980)	
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CONF-8009134-	(3. international meeting on solid electrolytes, Tokyo, Japan, 15-19 Sep 1980)	
1	6:14403	*See* LBL-11000
CONF-801011-	(4. ANS topical meeting on the technology of controlled nuclear fusion, King of Prussia, PA, USA, 14-17 Oct 1980)	
81	6:15101	*See* LBL-11602
CONF-801016-	(5. national passive solar conference, Amherst, MA, USA, 19-26 Oct 1980)	
19	6:13662	*See* SERI/TP-721-825
CONF-801034-	(33. ACS Pacific Coast meeting, San Francisco, CA, USA, 28 Oct 1980)	
9	6:13953	*See* PNL-SA-8639
CONF-801037-	(American Vacuum Society conference, Detroit, MI, USA, 13-17 Oct 1980)	
38	6:13543	*See* UCRL-84472
CONF-801045-	(DOE statistical symposium, Berkeley, CA, USA, 29-31 Oct 1980)	
8	6:14879	*See* PNL-SA-8987
CONF-801074-	(8. annual DOE compatibility meeting, Los Alamos, NM, USA, 14-16 Oct 1980)	
3	6:15176	*See* UCRL-84419
CONF-8010130-	(Waste-Rock Interactions Technology annual information meeting, Seattle, WA, USA, 13-15 Oct 1980)	
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CONF-8010160-	(52. IMOG gaging subgroup meeting, Los Alamos, NM, USA, 21 Oct 1980)	
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CONF-8010163-	(International workshop on acid digestion, Richland, WA, USA, 7-9 Oct 1980)	
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35	6:13457	*See* PNL-SA-9005
CONF-801107-	(ANS international conference, Washington, DC, USA, 17-21 Nov 1980)	
66	6:13873	*See* PNL-SA-8121
67	6:13489	*See* PNL-SA-8762
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CONF-801111-	(6. conference on application of accelerators in research and industry, Denton, TX, USA, Nov 1980)	
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CONF-801124-	(3. annual meeting of the Materials Research Society, Boston, MA, USA, 17-20 Nov 1980)	
44	6:14416	*See* PNL-SA-8672
45	6:13498	*See* UCRL-85483
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3	6:13790	*See* BNL-28892
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4	6:14428	*See* UCRL-85066
CONF-801155-	(3. annual symposium on uranium mill tailings management, Ft Collins, CO, USA, 24-25 Nov 1980)	
2	6:14757	*See* PNL-SA-9018
4	6:13490	*See* PNL-SA-8829
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1	6:13373	*See* SAND-80-2424C
CONF-801182-	(Automotive technology development contractor coordination meeting, Dearborn, MI, USA, 11-13 Nov 1980)	
1	6:14366	*See* DOE/NASA/51040-21
CONF-801206-	(ORNL conference on the leachability of radioactive solids, Gatinburg, TN, USA, 9-12 Dec 1980)	
10	6:13492	*See* PNL-SA-8931
11	6:13522	*See* PNL-SA-8935
CONF-801210-	(3. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 15-17 Dec 1980)	
20	6:13808	*See* PNL-SA-9066
21	6:13617	*See* PNL-SA-8603
22	6:13616	*See* PNL-SA-8602
23	6:14277	*See* BNL-28778
CONF-801217-	(Symposium on modeling and low-level waste management, Denver, CO, USA, 1-4 Dec 1980)	
4	6:13494	*See* PNL-SA-9077
CONF-801233-	(6. annual workshop on geothermal reservoir engineering, Stanford, CA, USA, 16-18 Dec 1980)	
5	6:13780	*See* LBL-12166
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7	6:13777	*See* LBL-12039
CONF-801242-	(Electric and hybrid vehicle advanced technology seminar, Pasadena, CA, USA, 8-9 Dec 1980)	
2	6:14373	*See* LA-UR-81-373
3	6:14138	*See* UCRL-85448
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1	6:13425	*See* PNL-SA-9086
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2	6:15109	*See* SAND-81-0074C
CONF-801247-	(US/Japan workshop on the theory of non-axisymmetric confinement systems, Austin, TX, USA, 8-12 Dec 1980)	
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CONF-801248-	(4. American Nuclear Society topical meeting on technology of controlled nuclear fusion, Valley Forge, PA, USA, 14-17 Dec 1980)	
1	6:14595	*See* LBL-12204
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6	6:13453	*See* DP-MS-81-3
CONF-810117-	(9. international workshop on gross properties of nuclei and nuclear excitations, Kleinwalsertal, Austria, Jan 1981)	
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CONF-810118-	(Army research office workshop on repetitive opening switches, Durango, CA, USA, 29-30 Jan 1981)	
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3	6:14079	*See* LA-UR-81-622
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3	6:14980	*See* CONF-810117-5
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6	6:13876	*See* SAND-81-0419C
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1	6:14976	NTIS, PC A03/MF A01
CONF-810203-	(AIME annual meeting, Chicago, IL, USA, 22-26 Feb 1981)	
3	6:14445	NTIS, PC A02/MF A01
5	6:14446	NTIS, PC A02/MF A01
6	6:13320	NTIS, PC A02/MF A01
CONF-810204-	(SPIE symposium on high-power lasers and applications, North Hollywood, CA, USA, 11-13 Feb 1981)	
3	6:14545	*See* DOE/DP/40069-4
CONF-810214-	(4. topical conference on radio frequency plasma heating, Austin, TX, USA, 9-10 Feb 1981)	
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8	6:13491	*See* PNL-SA-8872
9	6:13466	*See* DP-MS-81-4
10	6:13458	*See* PNL-SA-9247
11	6:13465	*See* DP-MS-80-77
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1	6:14880	*See* UCRL-85297
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1	6:14603	*See* SAND-81-0362C
CONF-810225-	(Workshop on seismic performance of underground facilities, Augusta, GA, USA, 11-13 Feb 1981)	
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1	6:13810	*See* SAND-80-2646C
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CONF-810233-	(3. Pacific Basin conference, Acapulco, Mexico, 16-18 Feb 1981)	
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9	6:14570	NTIS, PC A02/MF A01
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13	6:14602	*See* SAND-80-2492C
14	6:14599	*See* LA-UR-81-408
15	6:14600	*See* LA-UR-81-421
16	6:14593	*See* SAND-80-2446C
17	6:14606	*See* BNL-29055
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2	6:13380	*See* SAND-81-0444C
3	6:13307	*See* SAND-80-1751C
4	6:13611	*See* LA-UR-81-549
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3	6:14627	*See* SAND-80-2659C
4	6:14566	*See* LA-UR-81-377
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1	6:14900	*See* SAND-81-0321C
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2	6:13378	*See* SAND-80-2187C
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2	6:14966	*See* SAND-80-2516C
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1	6:13649	*See* LA-UR-80-3040
10	6:13805	*See* SERI/TP-732-1064
11	6:13664	*See* UCRL-85327
CONF-810417-		(90. AICHE national meeting, Houston, TX, USA, 5-9 Apr 1981)
2	6:14472	*See* SAND-80-2361C
CONF-810420-		(Workshop on laboratory EXAFS facilities and their relation to synchrotron radiation sources, Seattle, WA, USA, 28-30 Apr 1981)
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